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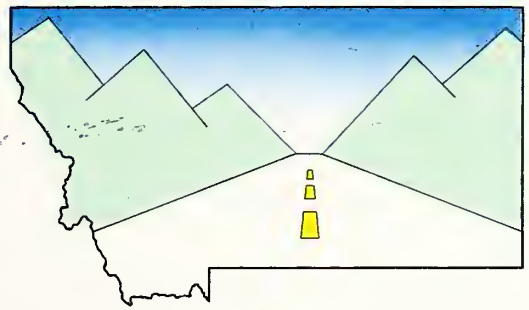
MONTANA
ACCIDENT PREVENTION UNIT

(APU)
EVALUATION 1973

A SELECTIVE TRAFFIC ENFORCEMENT PROGRAM

MONTANA SAFETY



Prepared and Submitted by

Highway Traffic Safety Division
Department of Intergovernmental
Relations, State of Montana

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MONTANA ACCIDENT PREVENTION UNIT EVALUATION

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INTRODUCTION

Selective enforcement may be defined as a method of optimizing the utilization of enforcement resources to maximize impact on those selected problem areas which offer the greatest potential for improvement; a management by exception technique in which enforcement is applied on a basis which is proportional to the location and frequency of occurrence of the problem being addressed by an enforcement continuance with respect to time, place, and type of violation. The establishment of preventive patrol to deal with specific categories of unlawful driving behavior is primary to this effort when it is based on specific needs identified by proper use and interpretation of historic data including: accident statistics, enforcement activity records, traffic volumes and other local traffic conditions.

This report deals with the evaluation of this selective enforcement or accident prevention unit activity in Montana during a specified time period.

The Montana driver and pedestrian population recently experienced the largest number of yearly fatalities in its history. Moreover, statistical projections of fatalities, as well as other indicators of accident exposure, demonstrate that increases in accidents and numbers killed can be anticipated in the future. Total vehicle miles driven are presently increasing at 10% per year, and are expected to double by 1980.

Accident injuries are expected to increase from 6587 in 1973 to 7513 by 1977. The total number of licensed drivers may reach 500,000 by 1975. These indicators, as well as others, represent an undesirable condition which cannot be altered unless maximum effort is mobilized to halt undesirable increases in accidents, injuries, and fatalities.

Selective enforcement represents a change in management philosophy designed to reduce fatalities and injuries in high accident locations and to maximize efficiency of law enforcement units. High accident locations are selected from data files utilizing an electronic computer. This site selection is based on roadway length, vehicle miles driven, accident frequency and severity, and major contributing circumstances. Scheduling of enforcement activity also considers accident frequency by time of day and day of week.

Public information in the form of radio messages and news releases is utilized to help inform the driving public of accident causes and educate them toward more safe driving habits.

Purpose Goals and Objectives of the Accident Prevention Unit.

The primary goal of the Accident Prevention Unit is to minimize the frequency and effects of traffic crashes in those geographical areas which have unusually high accident histories. Based on the professional judgement of the Montana Highway Traffic Safety Division idealized objectives for the Accident Prevention Unit include:

1) Reduction of the accident rate (number of accidents/100 million vehicle miles driven) by 10% in the selected high accident locations.

2) Reduction of accident severity in high accident locations.

3) Reduction of moving traffic violations by 25% in high accident locations.

4) Reduction of equipment violations by 25% in high accident locations.

5) Reduction of number of unlicensed drivers by 25%.

6) Increase public awareness of highway safety concepts and safe practices.

Some of the Accident Prevention Unit measures of the effectiveness in attaining the program objectives are:

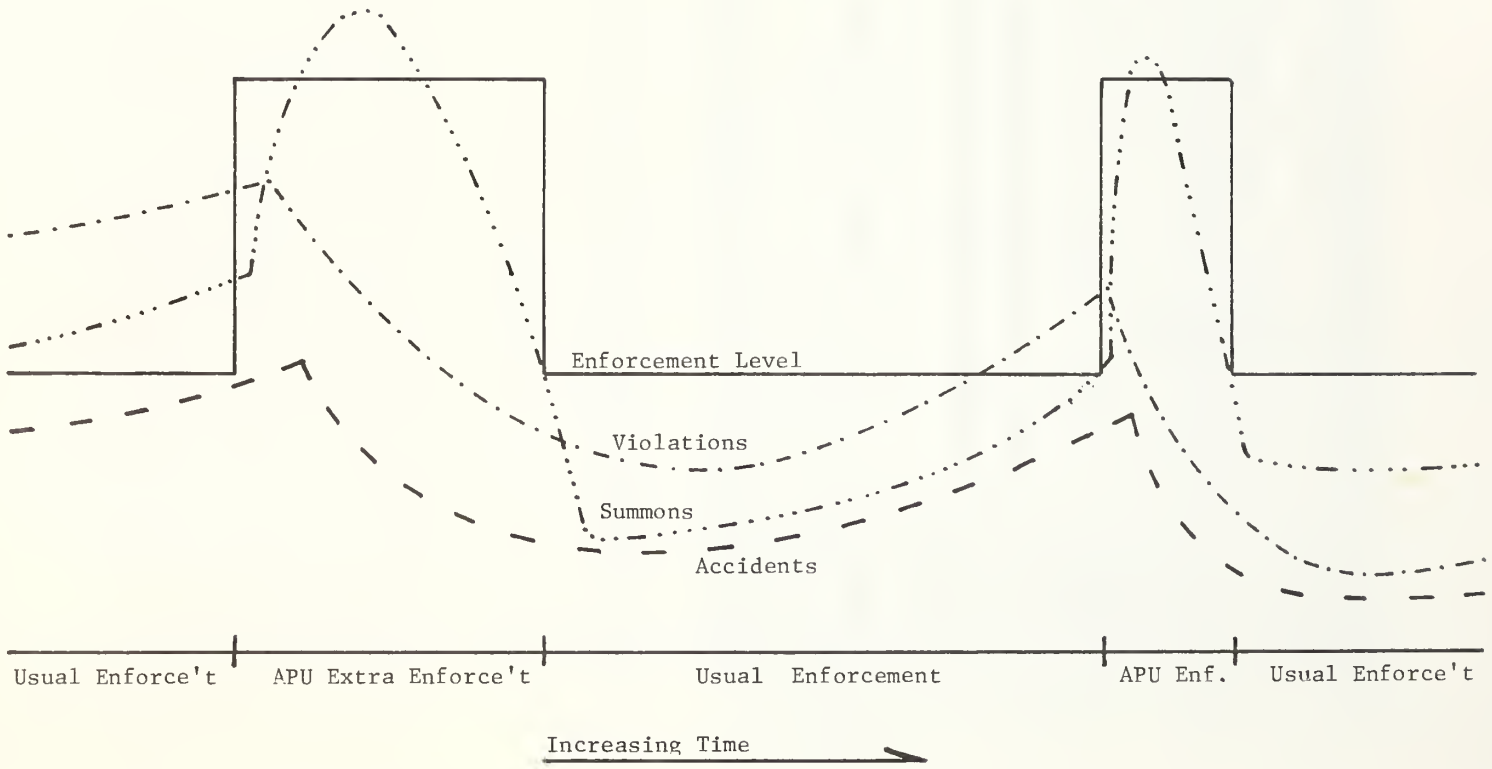
1) Accident data regarding number of fatalities, injuries, and crashes in the high accident locations both before and after APU activity.

2) Number and types of warnings and summons issued by the local patrolmen before and after the APU activity and by the APU staff.

3) Results of public survey questionnaires.

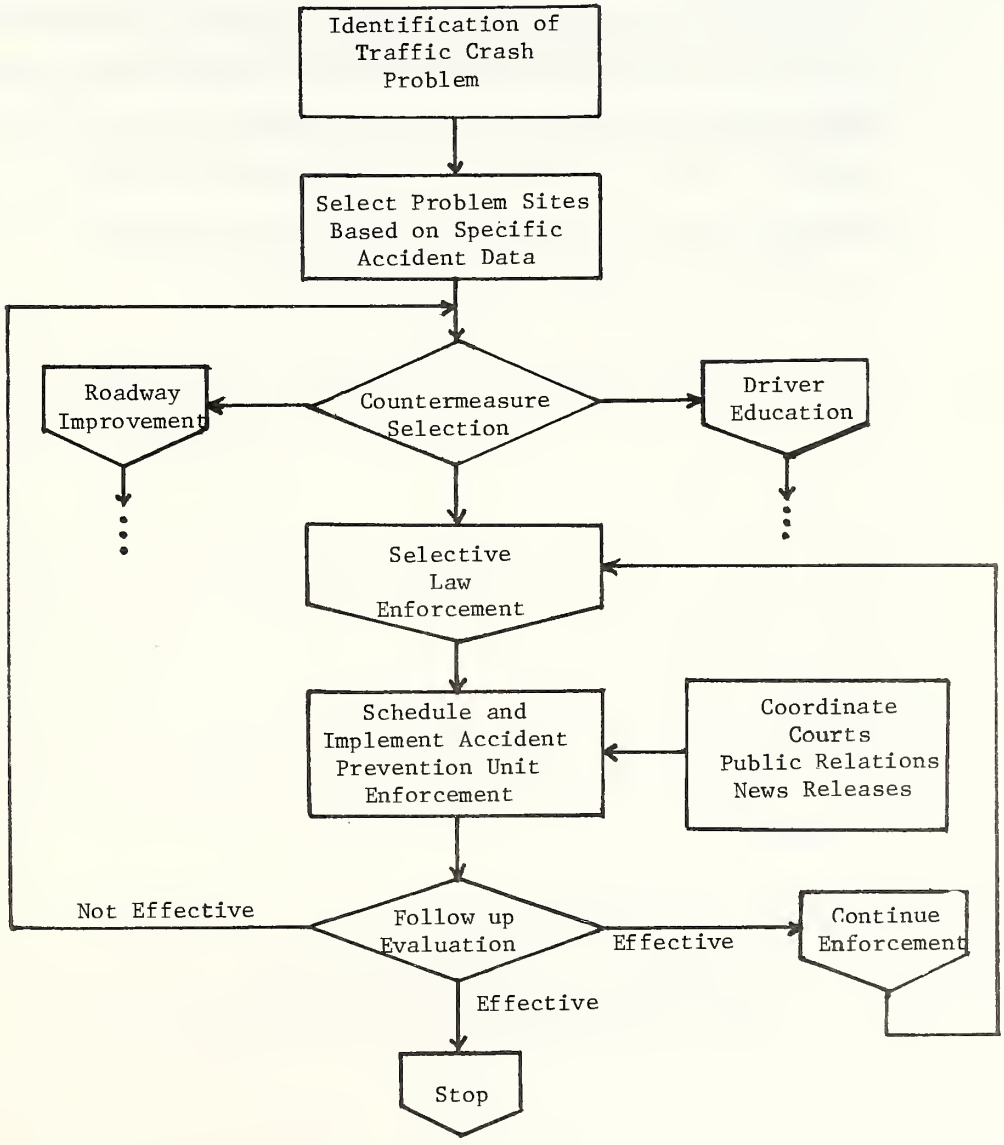
The following chart demonstrates the theoretical relationships between traffic accidents, enforcement levels, violations, and summons issued. A previous study of Accident Prevention Unit activity oriented towards evaluating these same objectives was completed in January 1973 and is titled US Highway 93 - Accident Prevention Unit. Findings of that study indicated a positive reduction in accidents and economic loss.

Conceptual Relationship Between Enforcement Level, Citations, Violations, and Accidents



This demonstrates only conceptual relationships. In actual practice variability in the accident data, reported violations, and enforcement priorities make these patterns very difficult to document.

The accident prevention unit operation is a process which may be illustrated by a systems type flow chart.



Evaluation Rationale

The effectiveness of any traffic control program or accident counter-measure may be determined by evaluation. Such an evaluation scheme should direct attention at program impact including economic feasibility or a cost benefit analysis of the program. The goals and objectives of the program should be reexamined and revised in the light of operatinal experience and performance and alternative modes of operation should be considered. Finally, information requirements for program evaluation and operations should be reviewed to eliminate extraneous data and to insure that necessary operational records are being kept.

This sort of evaluation should be conducted on a periodic basis. Some of the aspects of the evaluation may receive less emphasis in future evaluation studies.

Before, during, and after studies are essential if valid measures of effectiveness of accident prevention units are to be obtained using evaluation methods.

The goal of this evaluation is to determine the level of significance of the relationship between selective enforcement activity and accident crash rate changes.

Objectives of this evaluation are:

1. To determine if any decrease of accident crash rates can be measured at the two high accident sites covered in this report during selective enforcement.

2. To report any decrease in accident crash rates found to be measurable in evaluation objective 1 above.

3. To report any changes found in driver behavior in the two high accident sites covered in this report during selective enforcement.

4. To report the results of driver attitude surveys conducted in the two high accident areas covered in this report during selective enforcement.

5. To report methods of high accident location site selection used during the period of this evaluation.

6. To report additional factors discovered during the preparation of this evaluation concerning highway safety in the state of Montana.

7. To reexamine idealized objectives of the accident prevention unit and selective enforcement in the state of Montana.

Each of these objectives will be addressed in the section 2 of this report, the executive summary. Detailed analysis of collected data is contained in section 3.

EXECUTIVE SUMMARY

This section represents a summary of the results of this evaluation addressing each evaluation objective. The reader is encouraged to turn to section III of this report for detailed analysis and findings.

A good idea of the effect of concentrated selective enforcement on driver attitudes and driver behavior may be found in this report. Although accident impacts are not well defined, due to the relative rarity of accident occurrence, it is felt that follow-up studies lending themselves strictly to accident impact will prove the selective enforcement concept to be effective in reducing accidents, injuries and fatalities in Montana.

A report covering additional factors, not directly related to the APU but bearing upon the highway safety effort in total, is also presented in this section. These factors are a by-product of the basic evaluation but are believed to be valuable information for those working in the highway safety area.

APU Impact on Accident Experience.

The first two objectives of this evaluation report deal with the measurement of changes in accident crash rate experience at the selected high accident locations where the accident prevention unit operated.

The result of analysis performed in section 3 of this report indicates that significant measurement of change in accident crash rates is not possible within the enforcement time frames studied. The implication of this result is that, in high accident locations of a rural state such as Montana, a three to five week period of selective enforcement does not affect a large enough number of accidents to be significantly measured. Statistical variation within the accident data is larger than any change affected during this short period of time.

Accident causal factors as reported in Billings and Kalispell did show some definite changes which can be attributed to the APU activity. Failure to yield right of way, speed too fast, and had been drinking were reported as contributing circumstances much less frequently during the study period than had been the case otherwise. Based on professional judgment this decrease was an impact of the accident prevention unit.

A suggestion for future impact evaluation would be to schedule selective enforcement for a longer period of time in a high accident rural location. This longer time period would provide a greater accident base on which to affect changes and would increase the public's exposure to the educational aspects of the APU activity.

APU Impact on Driver Behavior

The third objective of this study is to report data pertaining to driver behavior and any significant changes in that behavior while the Accident Prevention Unit is active in high accident site.

The major tool used to measure driver behavior patterns was the ORBIS speed measuring and photo recording device. A detailed explanation of this device and connected methodology are found in section 3 along with resulting data. The device was scheduled to be deployed at the two sites covered in this evaluation on a before, during and after selective enforcement basis. A combination of adverse factors including weather prevented scheduled use of the device in the Billings area. The ORBIS operation in the Kalispell area was completed as scheduled.

A complete summary of data collected and comments may be found in section 3. The largest single measurable effect of the Accident Prevention Unit is in the behavior of drivers as related to speed. The speed distribution of vehicles by type, residence and time of week were studied from the point of before, during and after selective enforcement. In all cases, with the exception of trucks and buses, the overall distribution of vehicle speeds was reduced during the period of APU activity. The exception of trucks and buses (not including pickup trucks) may exist because these vehicles are subject to a speed limit at all times and are driving according to that limit. Therefore, enforcement would not be expected to change speed distributions of these vehicles. Although

overall distributions remain stable, some reduction in speeds over the legally allowable limit was noted in the truck data. A carryover effect in reduction of number of vehicles at higher speeds was indicated only for those behicles classed as pickups. Passenger car proportions at higher speeds were reduced during the actual presence of the Accident Prevention Unit but the after study indicates that the proportion at higher speeds had begun to return toward the speeds before enforcement with some carryover effect present.

APU Impact on Driver Attitude

As described in detail in section 3 a public survey was conducted as a part of this evaluation. Approximately one-half of the driving public was aware of the APU activity, and of these persons nearly 90% reported that they has seen it in action. Approximately 85 percent of these persons had also seen spot TV announcements or read of it in the news.

Between 50 and 75% of the persons aware of the APU felt that it was effective in 1) reducing drinking drivers, 2) reducing "unsafe" driving and 3) making drivers more alert to unsafe driving practices. Slightly over one-half of the population did not feel that drivers were educated to better driving habits, this is not in conflict with the above but reflects an attitude that drivers were already knowledgeable and were simply made aleat by the APU.

Over 97% of the driving public feel that the highway patrol is not too strict and only a very few indicated that it was too lenient. Nearly three fourths of the public felt more safe with the patrol present, but just as many expressed a desire for only regular patrol in thier area.

Selective Enforcement Site Selection

Three methods have been utilized in site selection during this evaluation. Since no evidence is available at this time with which to recommend use of a single method all three methods are presented in seciton 3 of this report.

The three methods presented have all utilized automated accident information. This information is currently available beginning with January, 1972. It is felt that at least three years of historic information should idealy be used as a basis for high accident location site selection as it becomes available. This would be an attempt to reduce variation which might cause selection of a site, which is not usually high in accidents, because of a short term problem.

Additional Factors Not Directly Related To The APU

A number of important facts not directly related to the APU activity have been documented during this evaluation. These are all examined in detail in section 3 but several of the more interesting observations are included in this summary.

A greater proportion of females were involved in accidents than were observed by orbis photos driving vehicles, this would indicate that females, in these locations at least, are less safe than male drivers.

Through the evaluation period, in the Kalispell area, the vehicle

occupancy rate was 1.69 occupants per vehicle. Weekdays showed 1.59 occupants while weekend occupancy increased to 1.81 occupants per vehicle.

While passenger cars made up 60% of the surveyed traffic in the Kalispell area they accounted for 68% of the accidents during the same time period. Pickups accounted for 22% of the traffic and a like portion of the accidents, while the 12% of the traffic which was composed of trucks and buses and 6% recreation vehicles were involved in lesser proportions of accidents.

The public survey in Billings and in Kalispell indicated several important driver characteristics, opinions, and behavior patterns. Older persons tend to favor more strict court penalities and a daytime speed limit, however, overall the public neither favors nor disfavors a daytime speed limit. Nearly 90% of female drivers reported fewer than 200 miles driven per week, whereas 44% of males drive more than 200 miles per week. Over three fourths of the drivers said they felt safe driving on area roads even though they reported having observed many instances of unsafe driving.

There are many other factual items of information which are detailed in section 3 and cannot be mentioned in this summary. The reader is encouraged to peruse the detailed analysis for those things having particular interest to him.

Idealized Objectives of the Montana Accident Prevention Unit

The final objective of this evaluation concerns reexamination of the idealized objectives of the Montana Accident Prevention Unit as presented in section 1 of this report. This reexamination will relate results of this evaluation report to the stated objectives of the accident prevention unit.

Since no measurement of change in accident rate figures was possible the first two objectives of the accident prevention unit cannot be changed based upon results of this report. These first two objectives deal with accident rates and accident severity.

The third and fourth idealized objectives of the accident prevention unit deal with reductions in traffic and equipment violations during a period of selective enforcement. The results of this evaluation indicate that although no decrease in summons issued was apparent, a decrease of over 50% in the number of warnings issued was found in the Kalispell area. Since no difference during the enforcement period in proportion of warnings by type is found, the 50% reduction figure may be assumed to extend to all types of warnings issued. These results indicate that when summons and warnings are taken as violations, the stated objective of a 25% reduction in violations is realistic and attainable.

The fifth idealized objective of the Accident Prevention Unit calls for a 25% reduction in the number of unlicensed drivers in a high accident site. Results of analysis of summons issued during the period of this evaluation, indicate that the proportion of summons issued for driver license violations remained fairly constant throughout the enforcement period. This would tend to indicate no measurable reduction in violations of drivers license laws in the studied locations. Since the unlicensed driver population in the state is currently unknown, based upon the professional opinion of safety personnel, this objective must remain unchanged.

A final objective of the Accident Prevention Unit concerns increasing public awareness of safety concepts and safe driving practices. The driver surveys conducted in the two sites included in this evaluation are of great assistance in definition of current public attitudes in the selected sites. A complete detailed analysis of the surveys is contained in section 3 of this report. Use of this type of survey is recommended for future measurement of change in public attitudes. After conducting further surveys, more explicit objectives in this area will be possible. The surveys conducted in connection with this evaluation will serve as a good baseline for any future research in this area.

DETAILED ANALYSIS

Introduction to Evaluation Techniques

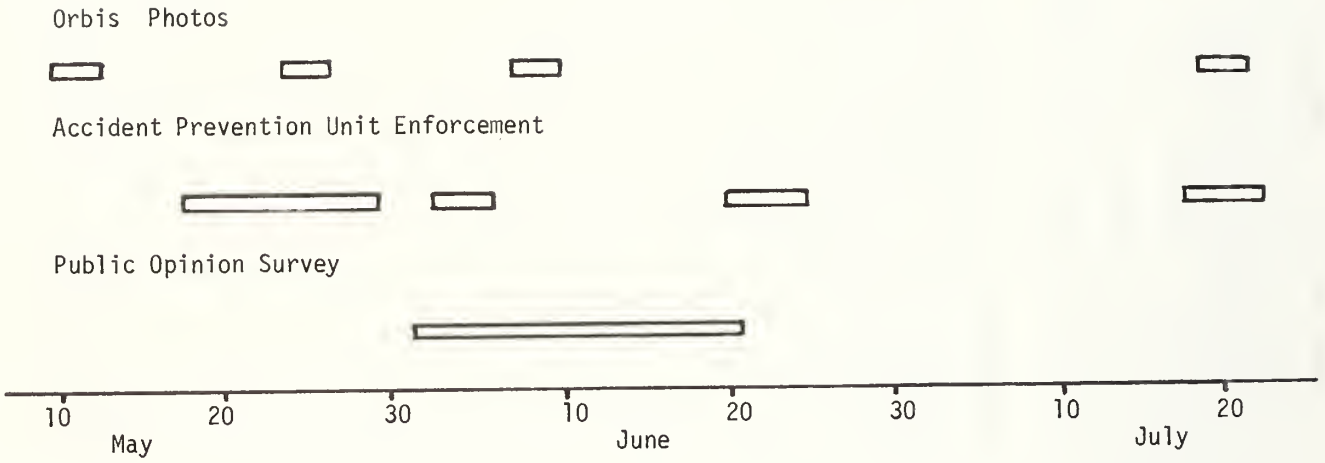
Two controlled sites, which had been preselected as high accident locations, were used in this study. Data related to crashes and driving behavior at these sites were gathered prior to the APU activity. They were also studied in detail during and following the APU activity period.

Baseline data related to the historical experience on the two selected locations included: accident statistics regarding 1972 fatalities, injuries, and property damage incidents and vehicle miles or average daily traffic (ADT). More than one year of historic data was not readily available but would have been very useful. The accident data included contributing circumstances, time of day and day of week, apparent law violation if any, etc. Traffic counts were obtained for the previous year from the state highway planning and survey office for the specific locations (road sections) involved during the time period of APU activity.

Data corresponding to and following the period of APU activity is quite detailed and includes the same accident data as the before information. In addition, speed and vehicle distributions by time of day and day of week were obtained from Orbis photos. Driver population profiles by sex, vehicle registration, and number of passengers are also available from these photos.

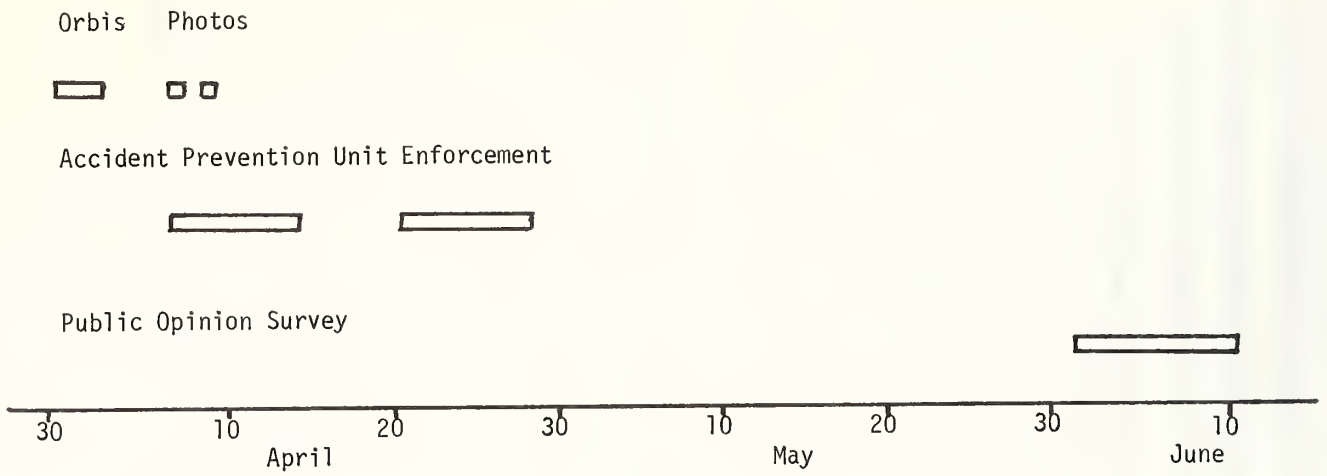
A complete record of summons issued and warning tickets written by type of violation was obtained and can be related to manpower committments.

These various types of data were compared in various ways utilizing contingency tables and related chi-square tests and in many cases direct comparison of year to year data on the APU locations within the frame of the statewide profile. This detailed analysis follows in subsequent portions of section 3.



EVALUATION SCHEDULING: KALISPELL 1973

This illustration demonstrates the time sequencing of the evaluation activities in the Kalispell area.



EVALUATION SCHEDULING: BILLINGS 1973

This illustrates the time sequencing of evaluation activity in the Billings area. The study was curtailed in this area because extremely heavy snowfall closed all roads on April 20. The accident prevention unit did roadblock duty and no orbis photos were taken. Original plans had called for these photos on April 26, 27, and 28 and on May 10, 11, 12. The public opinion survey was taken as scheduled.

Site Selection

Several criteria for site selection have been developed during the course of this evaluation process. All selections have been based upon automated accident records derived from statewide accident reports. Current automated records begin from January 1, 1972. Due to this constraint, site selections were based upon only one year of historical data. A suggestion for future site selection is to use two, or perferably, three years of historic data as it becomes available in automated form. Three major site selection methods will be mentioned here. These methods are Statewide Search, Seasonal Search, and Area Search. Data to justify the choice of one of these techniques over the others has not been obtained and therefore each type will be presented without recommendation.

The Statewide Search was the method used in arriving at the two major sites for selective enforcement, dealt with in this evaluation. This method begins with a search of accident records for clusters of historic accidents in a specified length of road. The initial search used was for 60 or more accidents in a specified length of road during the period January 1, 1972 through November 30, 1972. The result of this initial search was a group of 27 thirty-mile clusters from throughout the state. Included in these clusters were fatal, injury, and reportable property damage accidents. When these first clusters were found, a detailed analysis of each was obtained. This detailed analysis contained all of the following information:

a. Number of accidents by type (fatal, injury and property damage)

b. Average daily traffic.

c. Contributing circumstances.

d. First harmful event.

e. Road and weather characteristics.

f. Time of day; day of week

These data elements are all available in Montana's Highway Information System accident records from a rural accident analysis program. Accident rates are calculated by expansion of the average daily traffic into vehicle miles traveled and then arriving at the rate of accidents per 100 million vehicle miles traveled in this particular section of road. A comparison of each cluster found, by accident rates, will partially show which clusters would be emphasized as selective enforcement sites. Other factors from the detailed analysis should also be studied prior to final site selection. The most prominent of these other factors is the severity of accidents in a site. A greater return to the public in terms of societal cost savings can be realized by preventing, in order of importance: fatalities, injuries, and property damage accidents. To aid in this area, a fatality rate (fatalities per 100 million vehicle miles) should be calculated and compared to other sites. The final step is the actual decision as to which site to select for selective enforcement. At this time, final selection is a human subjective decision which should be based upon the objective results of the analysis of automated data. In general, the highest fatality rate sites should be rated highest priority. This allows greatest societal cost savings if reductions of

fatalities through selective enforcement can be obtained.

The Seasonal Search is a method of site selection which duplicates the previous procedure in all but the initial search. When scheduling for a given time period (for example, three months), the initial cluster search utilizes only historical accidents from those same months. The advantage of this search method is that seasonal trends in accidents from other than the pertinent time frame are considered and eliminated. Once the initial clusters are determined using this method, duplication of the Statewide Search method from analysis to final site selection is then accomplished.

The Area Search also parallels the two previous methods in all areas but the original cluster capture. The clusters sought in this method are predetermined areas (for example, a patrol division, a county, or a specific road). Once initial clusters are determined, again duplication of the analysis and final selection is used.

The two sites selected for this evaluation consisted of the following Montana highways.

Billings Area

ROUTE	MILEPOST
Primary 2; U.S. 10	466 - 490
Primary 53; Mont 3	0 - 30
Primary 4; U.S. 310	23 - 53
Primary 16; U.S. 87	60 - 90
Interstate 90	420 - 480
Interstate 94	0 - 30

Kalispell Area

Primary 1; U.S. 2	96 - 156
Primary 5; U.S. 93	85 - 145

All reference in this evaluation to Billings area or Kalispell area implies the above sections of Montana primary and Interstate highways.

Accident Information

Billings area accident information is summarized below for the periods before entrance of the APU into the area (January 1 to April 6) and after entrance of the APU (April 7 to July 31). The years 1972 and 1973 are presented.

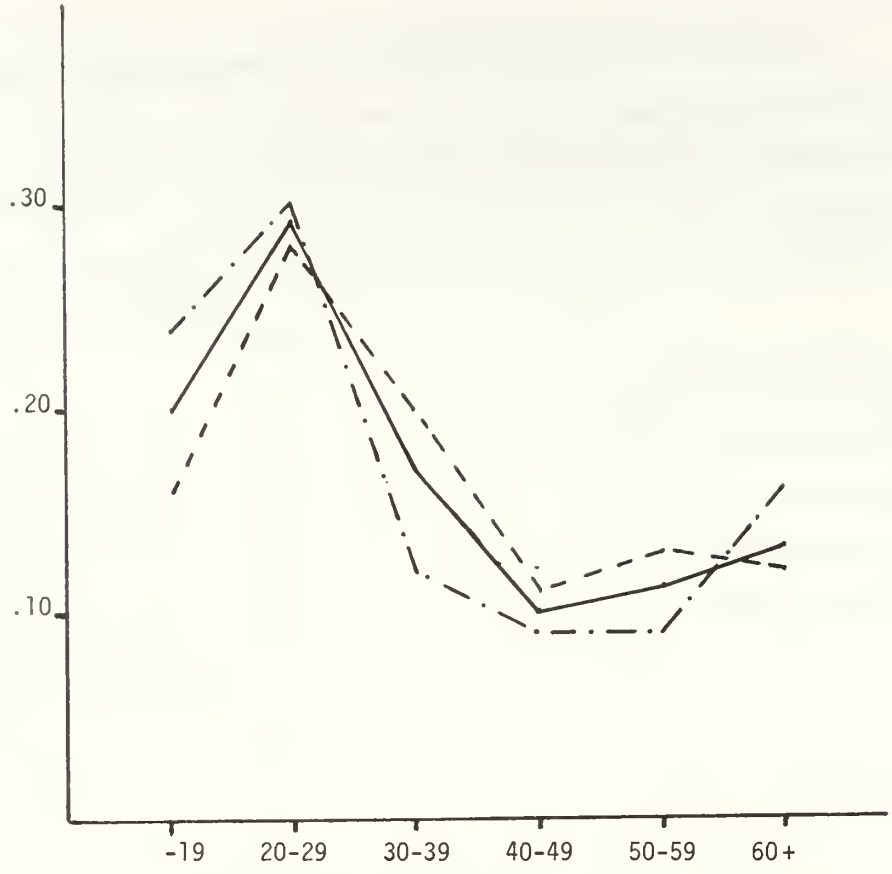
	January 1 to April 6	
	1972	1973
Fatalities.....	1	8
Fatal Accidents.....	1	7
Injuries.....	76	59
Injury Accidents.....	50	39
Property Damage.....	88	56

	April 7 to July 31	
	1972	1973
Fatalities.....	2	5
Fatal Accidents.....	2	5
Injuries.....	95	91
Injury Accidents.....	56	52
Property Damage.....	78	59

Kalispell area accident information is summarized below for the periods before (January 1 to May 18) and after (May 19 to July 31) the APU entrance into the Kalispell site. The years 1972 and 1973 are presented.

	January 1 to May 18	
	1972	1973
Fatalities.....	0	0
Fatal Accidents.....	0	0
Injuries.....	71	61
Injury Accidents.....	42	38
Property Damage.....	53	43

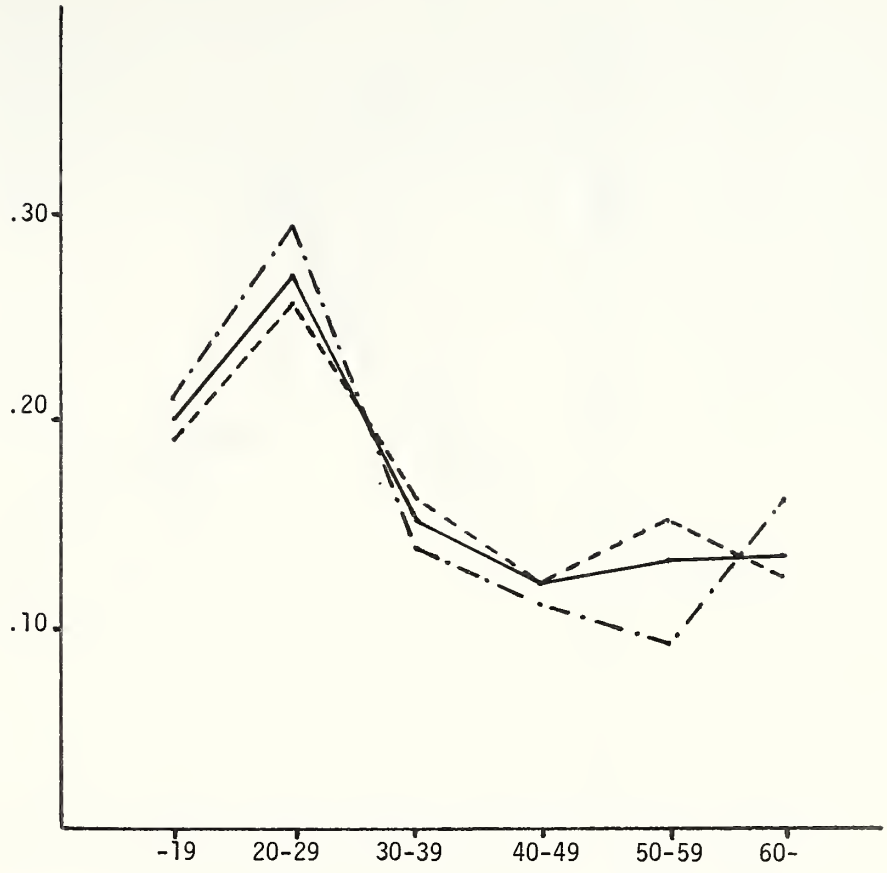
	May 19 to July 31	
	1972	1973
Fatalities.....	1	4
Fatal Accidents.....	1	3
Injuries.....	40	40
Injury Accidents.....	31	23
Property Damage.....	31	24



ACCIDENT DISTRIBUTION BY AGE: KALISPELL 1972

Age	Jan-May 18	May 19-July	Jan-July
-19	.16	.24	.20
20-29	.28	.30	.29
30-39	.20	.12	.17
40-49	.11	.09	.10
50-59	.13	.09	.11
60-	.12	.16	.13

This chart indicates the proportion of persons of a given age involved in accidents in the Kalispell area during selected time periods for 1972. Note that accident involvement for age groups -19 and 60+ increase during June and July. This may be due to their increased exposure or due to general increased traffic conditions exceeding their driving skills.



ACCIDENT DISTRIBUTION BY AGE: KALISPELL 1973

Age	Jan-May 18	May 19-July	Jan-July
-19	.19	.21	.20
20-29	.26	.29	.27
30-39	.16	.14	.15
40-49	.12	.11	.12
50-59	.15	.09	.13
60-	.12	.16	.13

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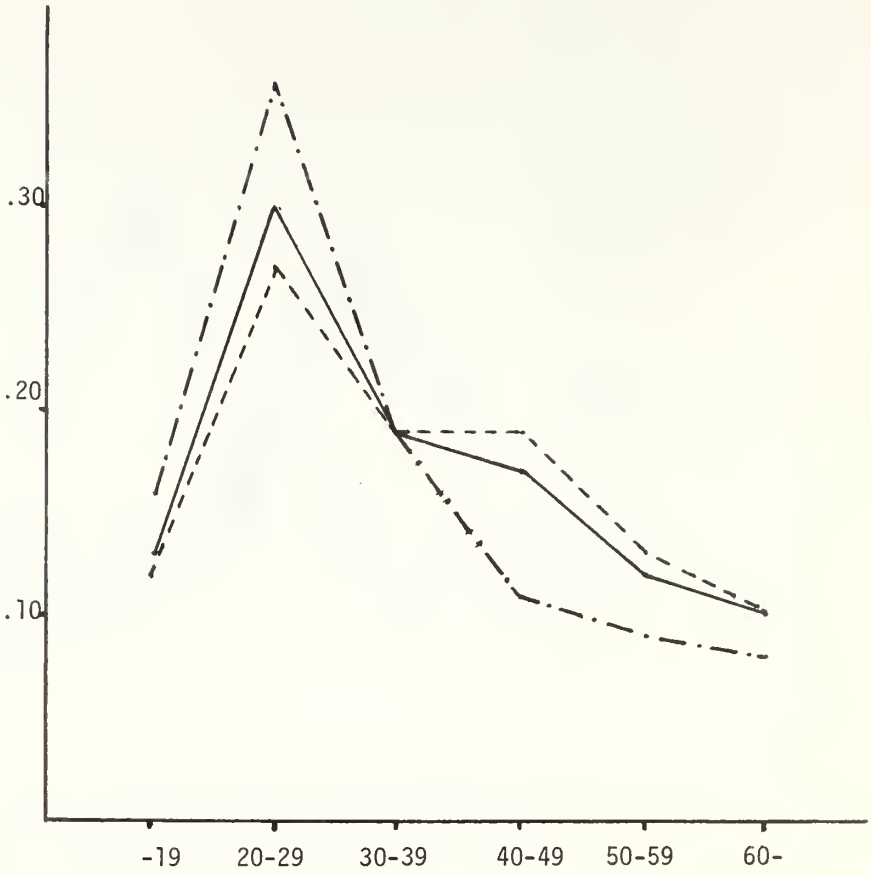
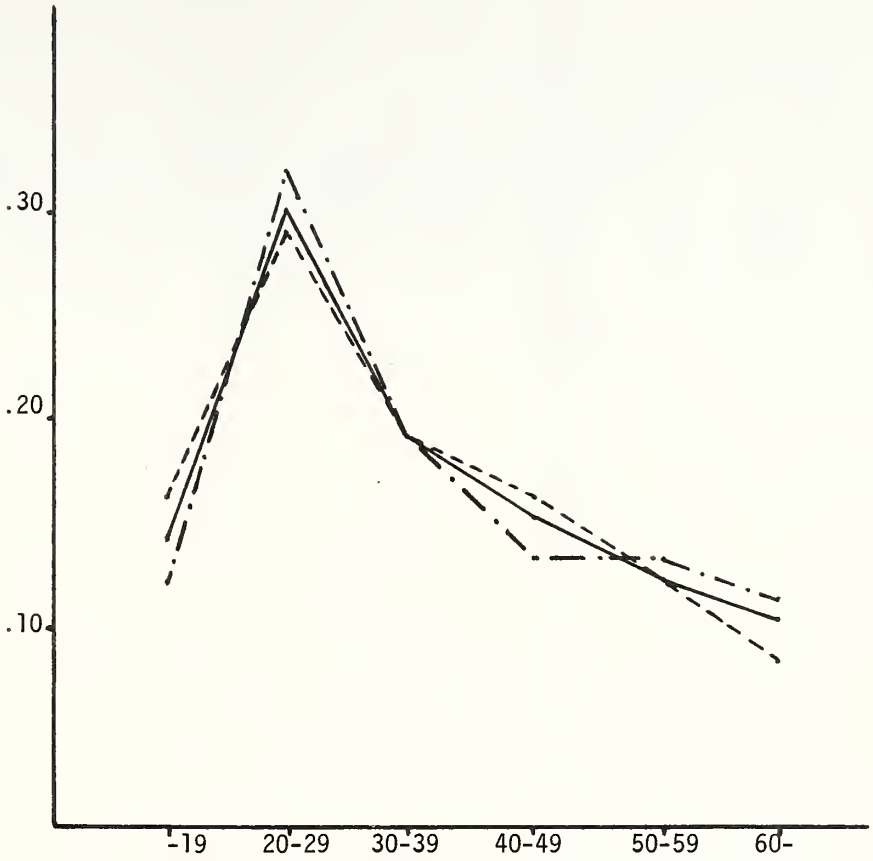


ACCIDENT DISTRIBUTION BY AGE: BILLINGS 1972

Age	Jan.-Apr. 6	Apr. 7-July	Jan.-July
-19	.12	.16	.13
20-29	.27	.36	.30
30-39	.19	.19	.19
40-49	.19	.11	.17
50-59	.13	.09	.12
60-	.10	.08	.10

This chart indicates the proportion of persons of a given age involved in accidents in the Billings area during selected time periods for 1972. Note that accident involvement for age group -19 and 20-29increase during June and July. This may be due to their increased exposure or due to general increased traffic conditions exceeding their driving skills.



ACCIDENT DISTRIBUTION BY AGE: BILLINGS 1973

Age	Jan-Apr. 6	Apr. 7 July	Jan-July
-19	.16	.12	.14
20-29	.29	.32	.30
30-39	.19	.19	.19
40-49	.16	.13	.15
50-59	.12	.13	.12
60-	.08	.11	.10

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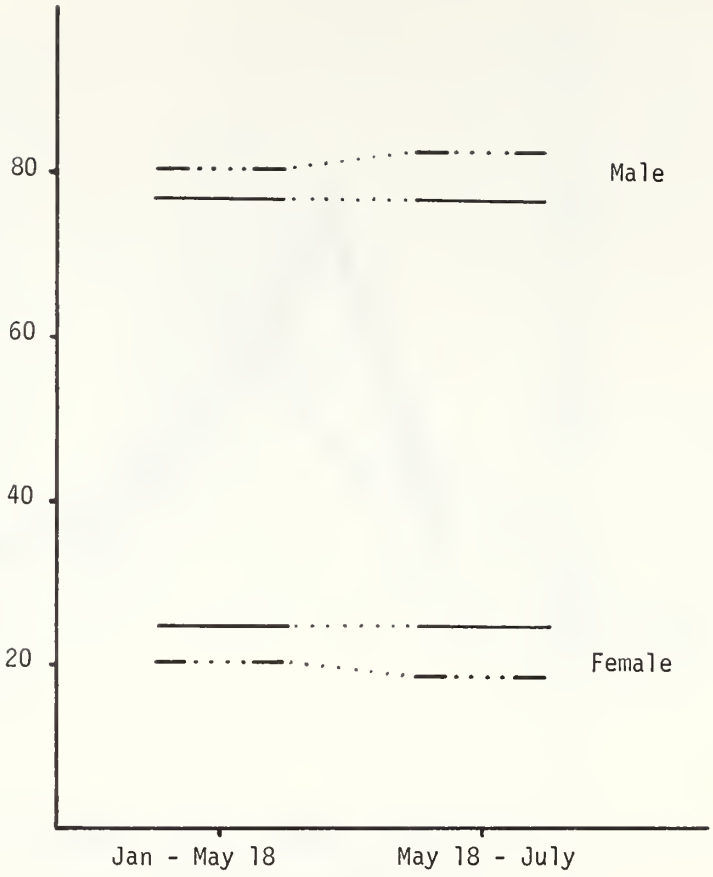
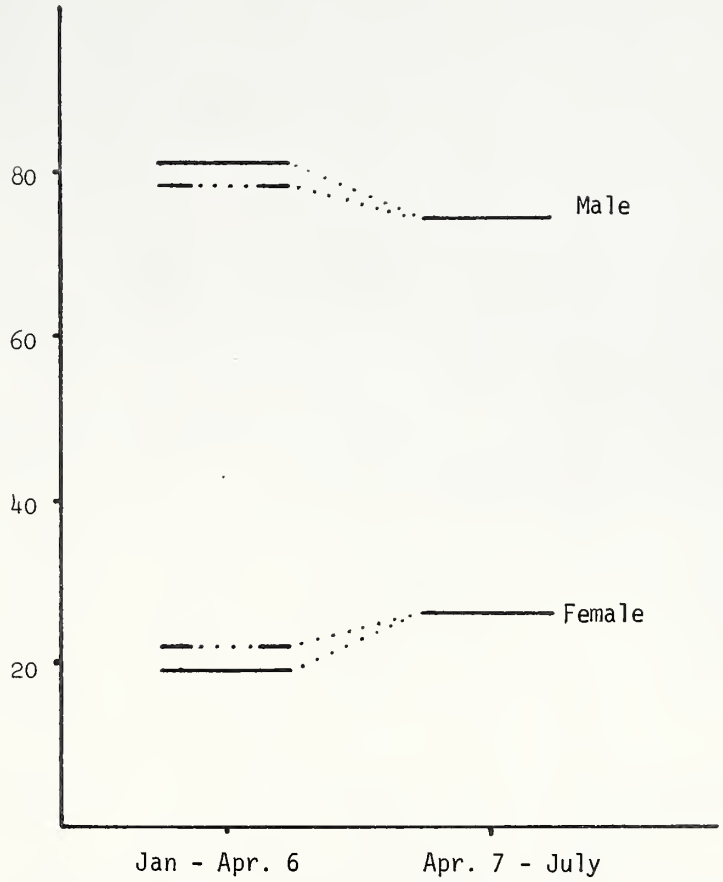


KALISPELL AREA: Percent by sex of drivers in accidents

	1972		1973	
	Males	Females	Males	Females
Jan-May 18	80	20	74	26
May 19-July	82	18	74	26
Jan-July	81	19	74	26

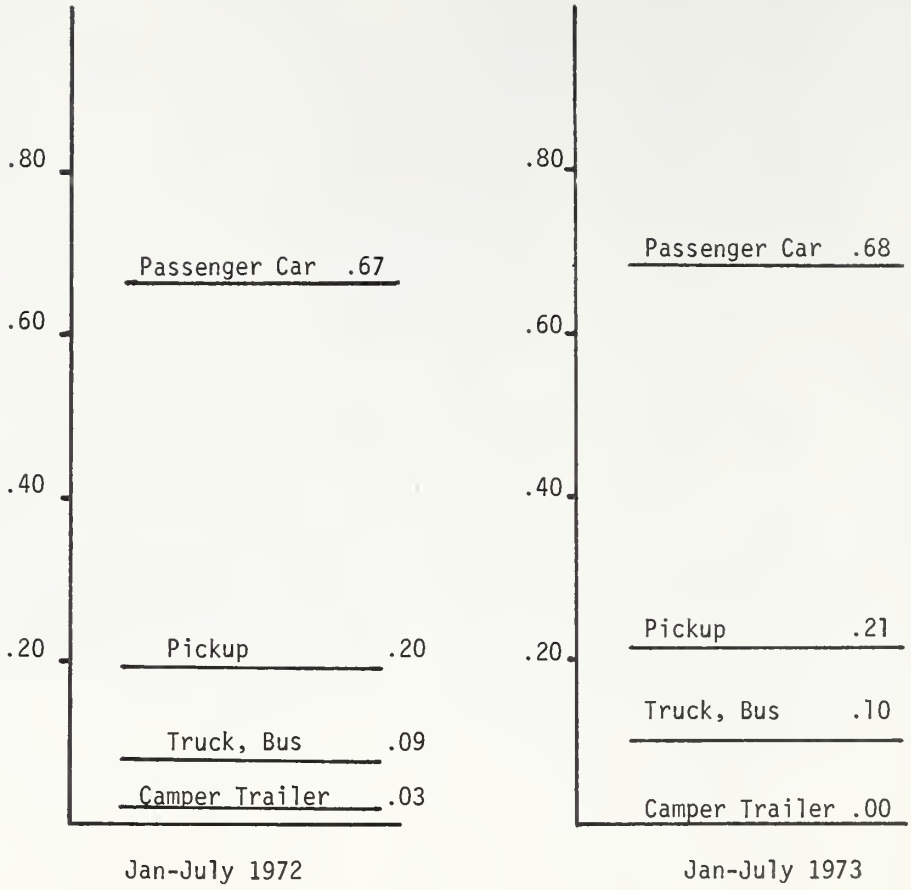
There is no evidence to indicate that the APU had a greater effect on one sex than the other, however, it is clear that male involvement in accidents is lower than their proportionate exposure as evidenced by the Orbis photos. In the Kalispell area only 16% of the drivers were females. See page 3.28.



BILLINGS AREA: Percent by sex of drivers in accidents

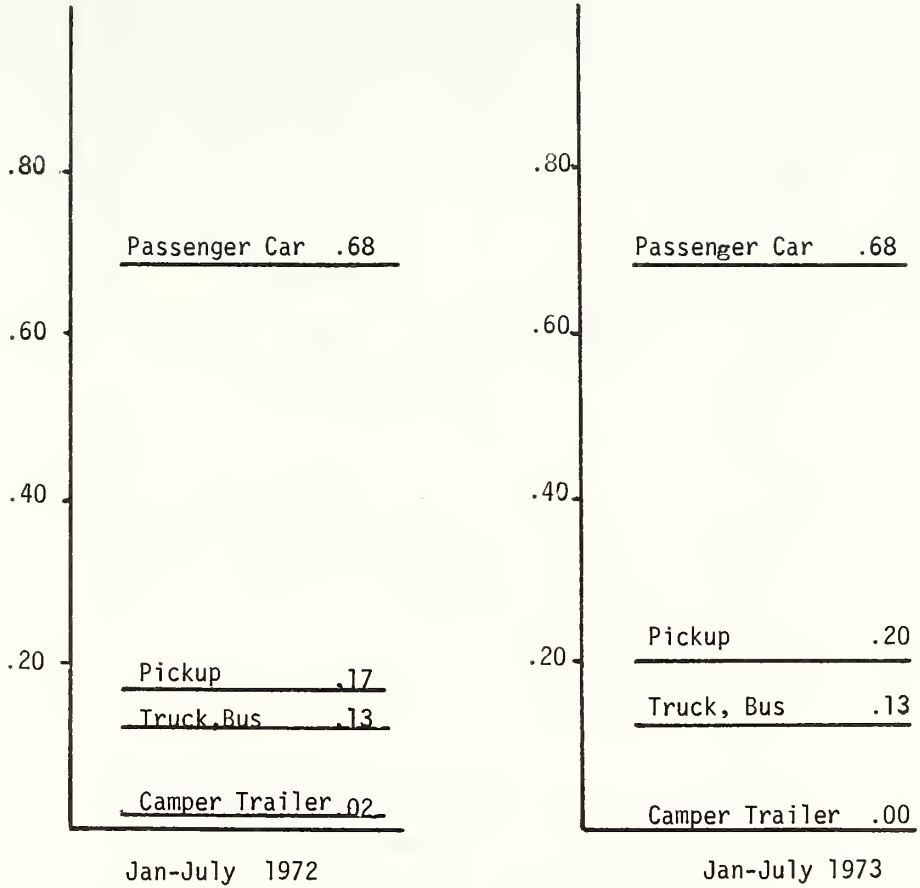
	1972		1973	
	Male	Female	Male	Female
Jan-Apr. 6	78	22	81	19
Apr 7-July	74	26	74	26
Jan - July	76	24	77	23

There is no evidence to indicate that the APU had a greater effect on one sex than the other, however, the orbis photos in the Billings area show only 8% female drivers compared with 26% females involved in accidents during the same time period.



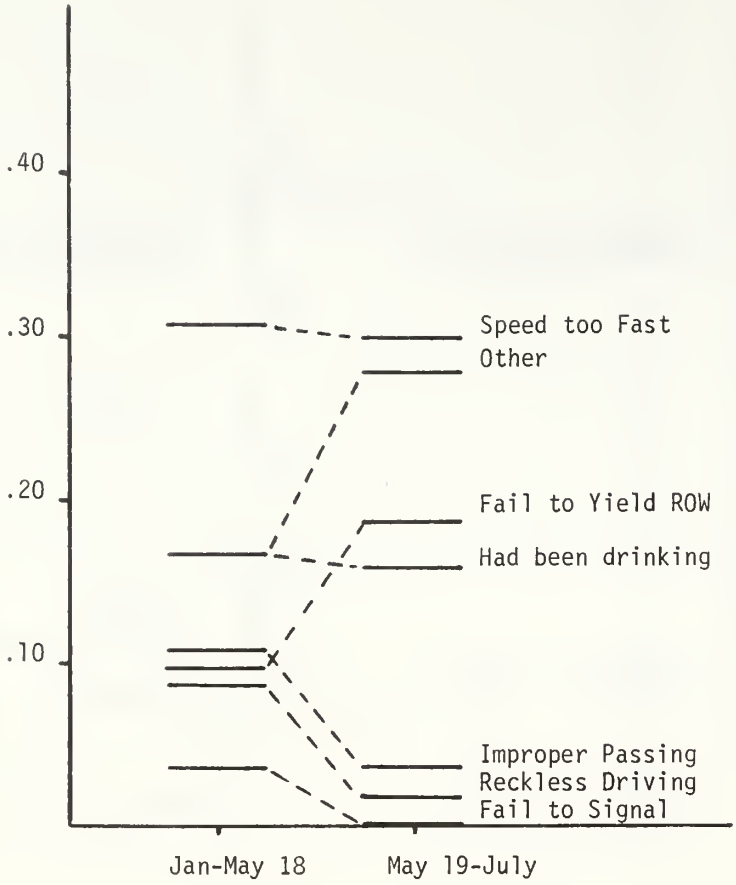
ACCIDENTS BY VEHICLE TYPE: KALISPELL

These charts indicate the proportions of vehicles of a given type involved in accidents in the Kalispell area during the January through July period of 1972 and 1973. These charts may be compared with the proportions of vehicle types which were observed on the roadways in the Kalispell area utilizing the orbis photos taken in 1973. Passenger cars are involved in more accidents than would be indicated by their exposure, while trucks, buses, and recreational vehicles are involved in fewer accidents than might be expected. See page 3.30.



ACCIDENTS BY VEHICLE TYPE: BILLINGS

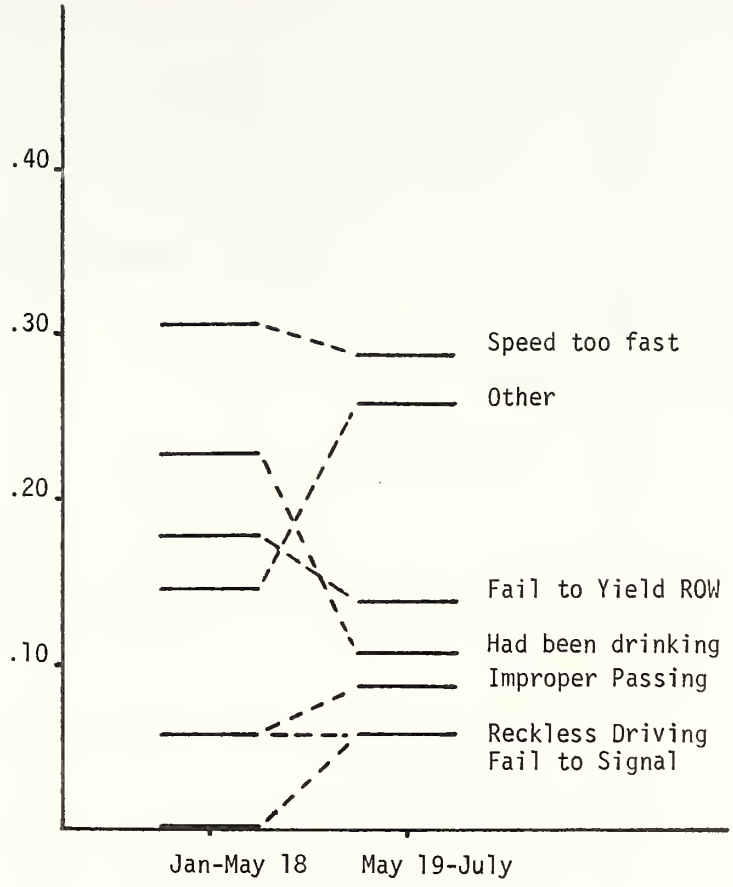
These charts indicate the proportions of vehicles of a given type involved in accidents in the Billings area during the January through July period of 1972 and 1973. Orbis data for the Billings area was not complete enough to allow accident involvement and exposure rate comparisons.



ACCIDENTS BY POSSIBLE VIOLATION: KALISPELL 1972

	Jan-May 18	May 19-July
Speed too Fast	.31	.30
Had been Drinking	.17	.16
Improper Passing	.11	.04
Fail to Yield ROW	.10	.19
Reckless Driving	.09	.02
Fail to Signal	.04	.00
Other	.17	.28

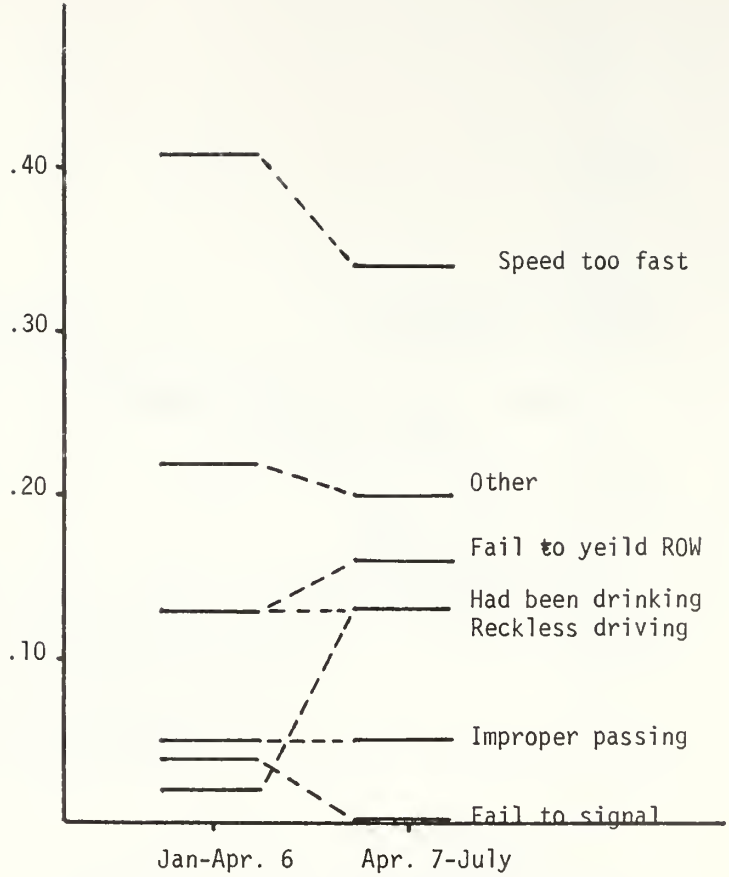
This chart illustrates proportions of possible violations among those accidents where a possible violation was recorded. Of all accidents only 48% indicated a possible violation and in 52% there was no apparent violation.



ACCIDENTS BY POSSIBLE VIOLATION: KALISPELL 1973

	Jan-May 18	May 19-July
Speed too fast	.31	.29
Had been drinking	.23	.11
Improper passing	.06	.09
Fail to yield ROW	.18	.14
Reckless driving	.06	.06
Fail to signal	.00	.06
Other	.15	.26

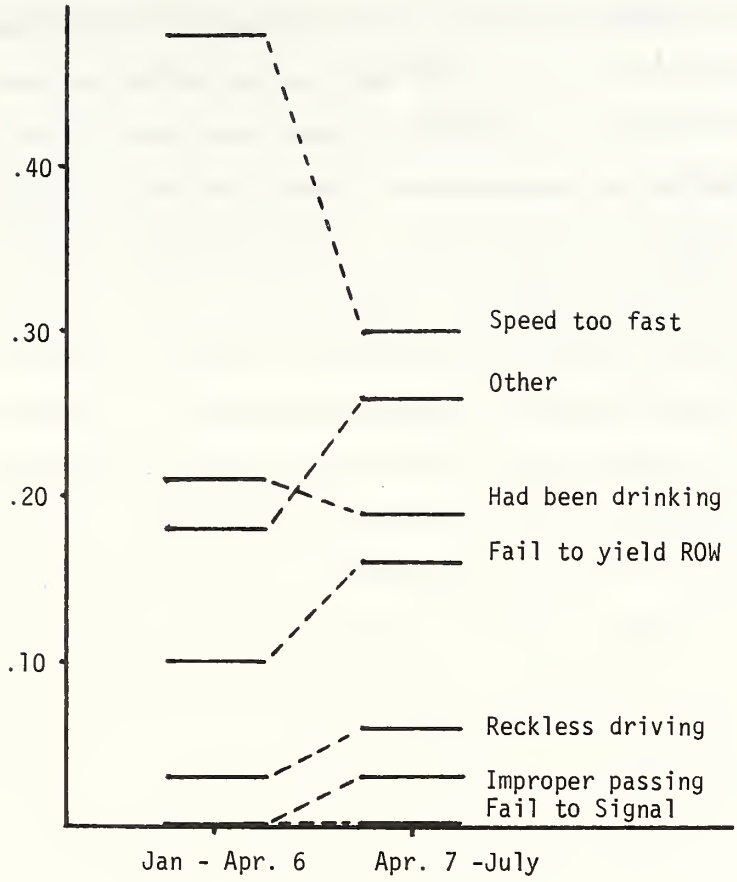
This chart illustrates proportions of possible violations among those accidents where a possible violation was recorded. Of all accidents only 55% indicated a possible violation and in 45% there was no apparent violation.



ACCIDENTS BY POSSIBLE VIOLATION: BILLINGS 1972

	Jan-Apr. 6	Apr. 7- July
Speed too Fast	.41	.34
Had been drinking	.13	.13
Improper passing	.05	.05
Fail to Yield ROW	.13	.16
Reckless Driving	.02	.13
Fail to Signal	.04	.00
Other	.22	.20

This chart illustrates proportions of possible violations among those accidents where a possible violation was recorded. Of all accidents only 55% indicated a possible violation and in 45% there was no apparent violation.



ACCIDENTS BY POSSIBLE VIOLATION: BILLINGS 1973

	Jan-Apr. 6	Apr.7 -July
Speed too fast	.48	.30
Had been drinking	.21	.19
Improper passing	.00	.03
Fail to yield ROW	.10	.16
Reckless driving	.03	.06
Fail to signal	.00	.00
Other	.18	.26

This chart illustrates proportions of possible violations among those accidents where a possible violation was recorded. Of all accidents only 55% indicated a possible violation and in 45% there was no apparent violation.

Orbis- Traffic Profile and Driver Behavior

The ORBIS speed measuring device combines a speed measuring computer, road detectors and a camera system that records on film the speed, time of day, and the vehicle. The ORBIS III Speed Survey Device is presently being marketed by the Boeing Aircraft Company Electronics Division, Box 24666, Seattle, Washington, 98124. The photograph allows the analyst to determine vehicle registration, vehicle type, and other information about the driver or passengers as required. The detectors used during this study consisted of two bi-metal strips encased in a rubber envelop stretched across one lane of traffic at right angles to the center line. A field expedient was used to hold the detectors in place. This consisted of 1/16" aircraft cable threaded through the envelop and anchored on both sides of the roadway. In addition three small chains were anchored over the detectors with pavement nails. This completely eliminated the need for taping the detectors to the pavement and did away with the flopping or twisting of the dectors.

Cost Data:

1.	Rental per Orbis Unit	$225.00 each/month
2.	Film, Kodak 2475	$13.00/125' roll
3.	Processing	$0.04/ft.
4.	Vehicle Rental	$0.12/mile or $4.00/hr.
5.	Personnel	1 man (3 man days per location)-variable

The sites selected for evaluation were those areas found to be high accident locations and at which the Accident Prevention Unit was scheduled.

The actual locations of the Orbis Unit were selected based upon the following criteria:

1. Representative Traffic Flow
2. Inconspicious to majority of drivers.
3. Out of direct rays of sun in the morning and evening (North or South facing).
4. Reasonable access to 120 V 60 cycle AC power source (± 200').

Traffic was sampled for five (5) minutes out of each fifteen minutes for a 24 hour period. The primary reason for the sampling was simply to reduce the number of photos that needed to be analyzed. The cost savings in film and developing is so small as to be inconsequential. The sampling was accomplished by interrupting the lead sensor with an electric timer for 10 minutes out of each 15 minutes. This technique allowed such things as hourly fluctuations of traffic to be detected.

The following are the major problems encountered.

1. One problem that was never completely solved was that of film selection. It would appear that there are so many variables in light and weather conditions that there is no best film. Kodak RAR 2475 seemed to be a good compromise.

2. Focusing proved to be a problem because of the great variation of speed on a rural section of highway. Here again a compromise must be worked out at the site.

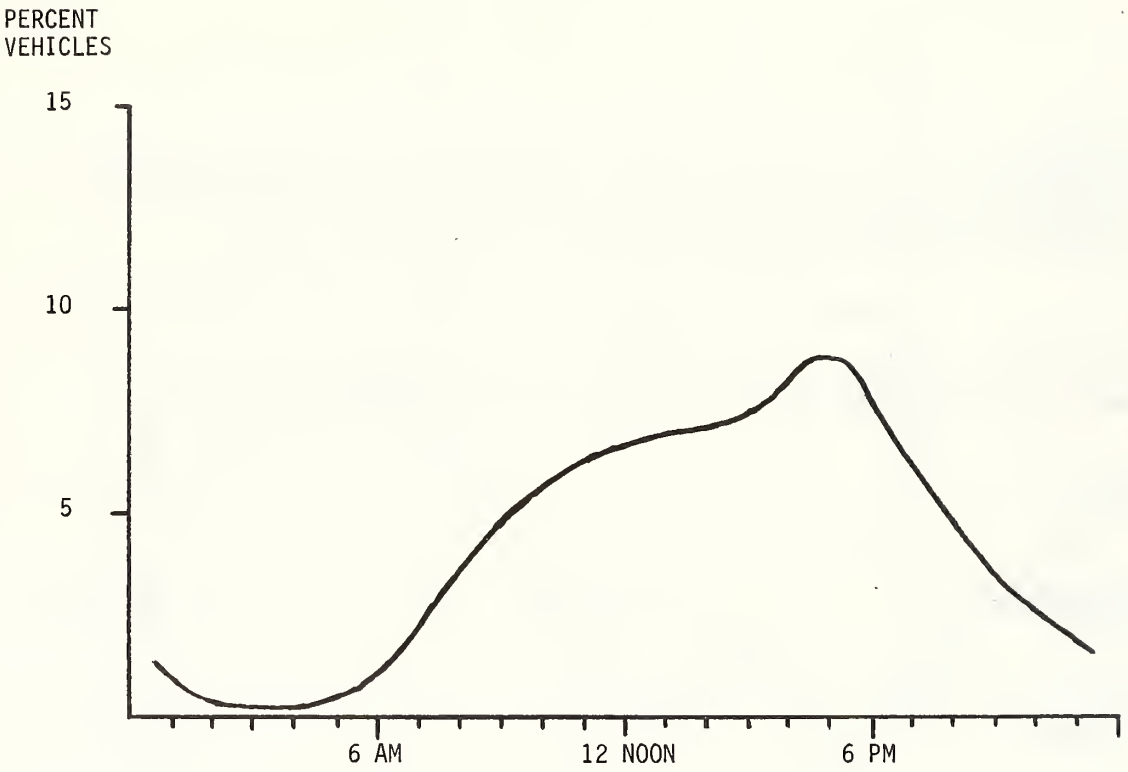
3. Aiming is a critical factor and it is suggested that some

trial photos be developed at the scene and adjustments be made based upon these photos.

The following settings are recommended for best results.

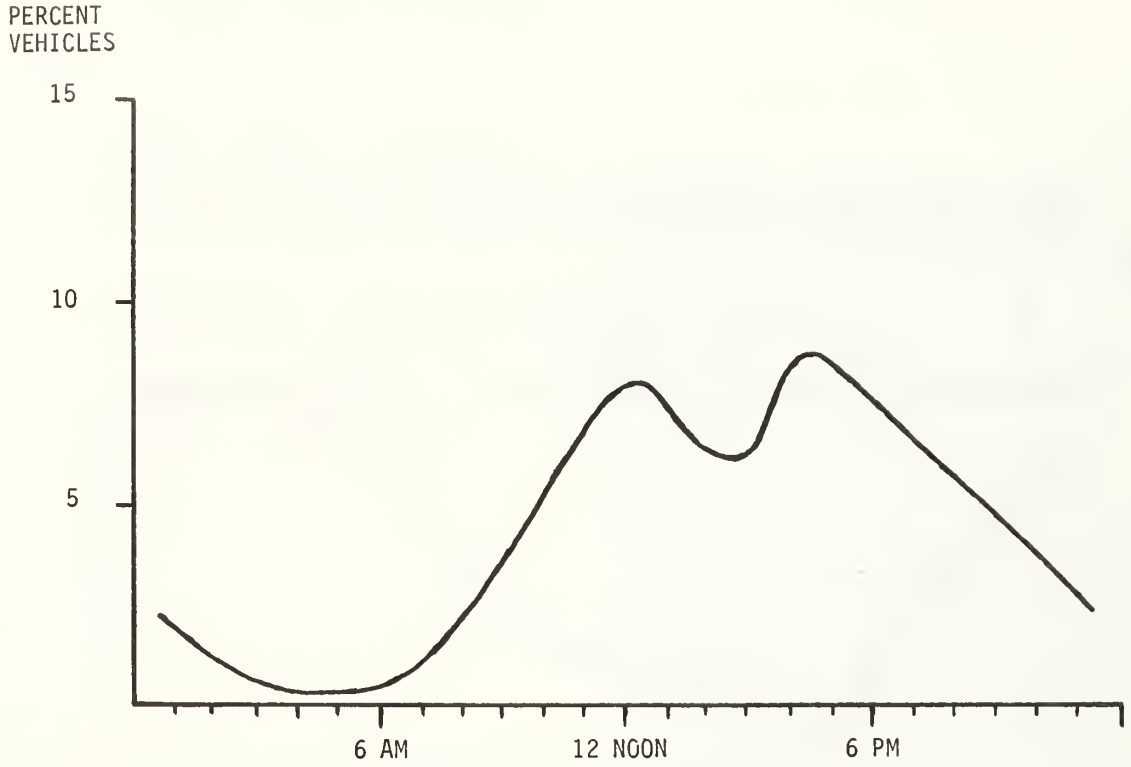
1. Objective lens of the camera about 20' (twenty feet) lateral clearance from the edge of traffic lane.
2. Timer set at 5 minutes on and 10 off.
3. Kodak 2475 RAR film used around the clock.
4. During daylight utilize the red filter, have the polarizer in front of the lens, set the largest 'f' stop on the camera, turn the strobe light off, and have the data block hooded.
5. During darkness utilize the same settings as above with the exceptions of having the strobe light on and the polarizer removed from in front of the lens.

The Orbis made possible the collection of traffic data which was heretofore either not available or proved to be very expensive to collect. (Vehicle registration at night for example) In its present form the device has numerous problems associated with its operation; however, the amount of information it provides more than makes up for these problems. The need for a trial run with the field operators cannot be over emphasized. This should consist of one 24 hour period during which time adjustments to the system should be made and checked.



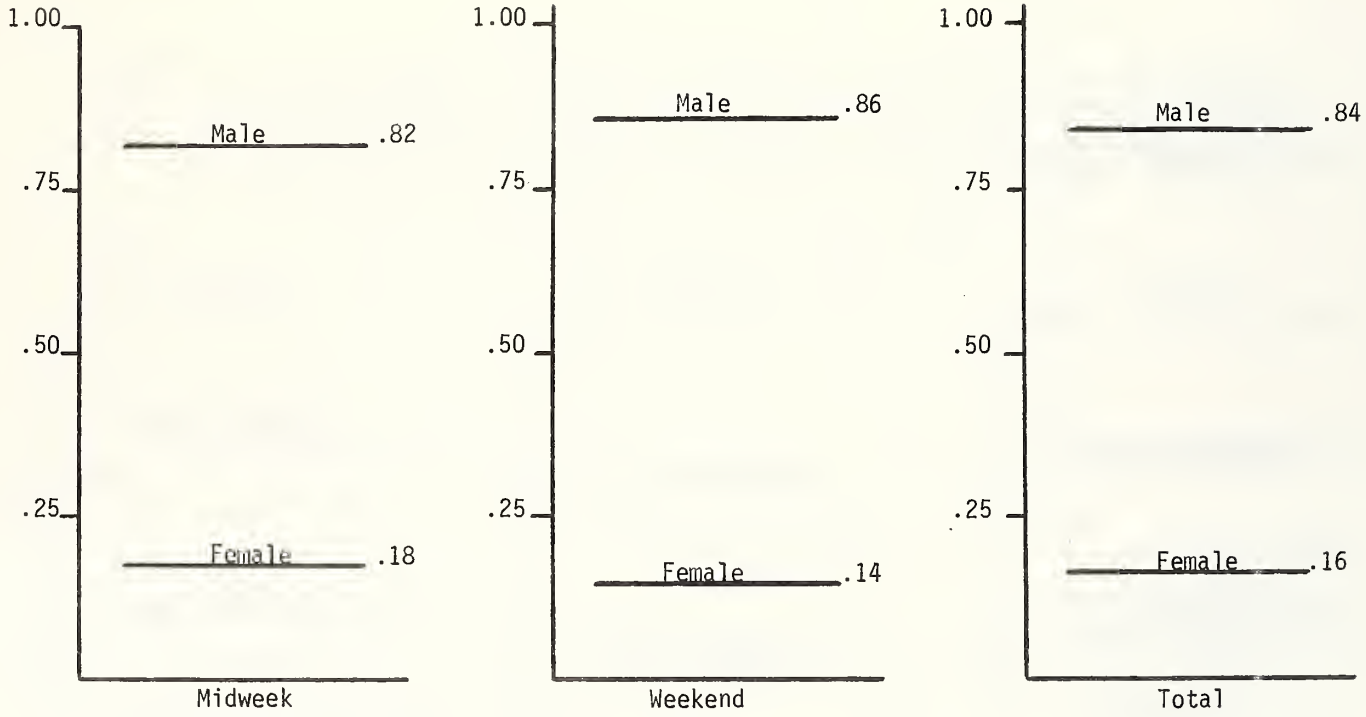
KALISPELL AREA: Midweek Traffic by Hour; STEP Effort.

It may be noted on this chart that the peak traffic occurs between 4 and 6 PM., which is similar to the weekend hour distribution. Lowest traffic occurs from 2 to 5 AM.



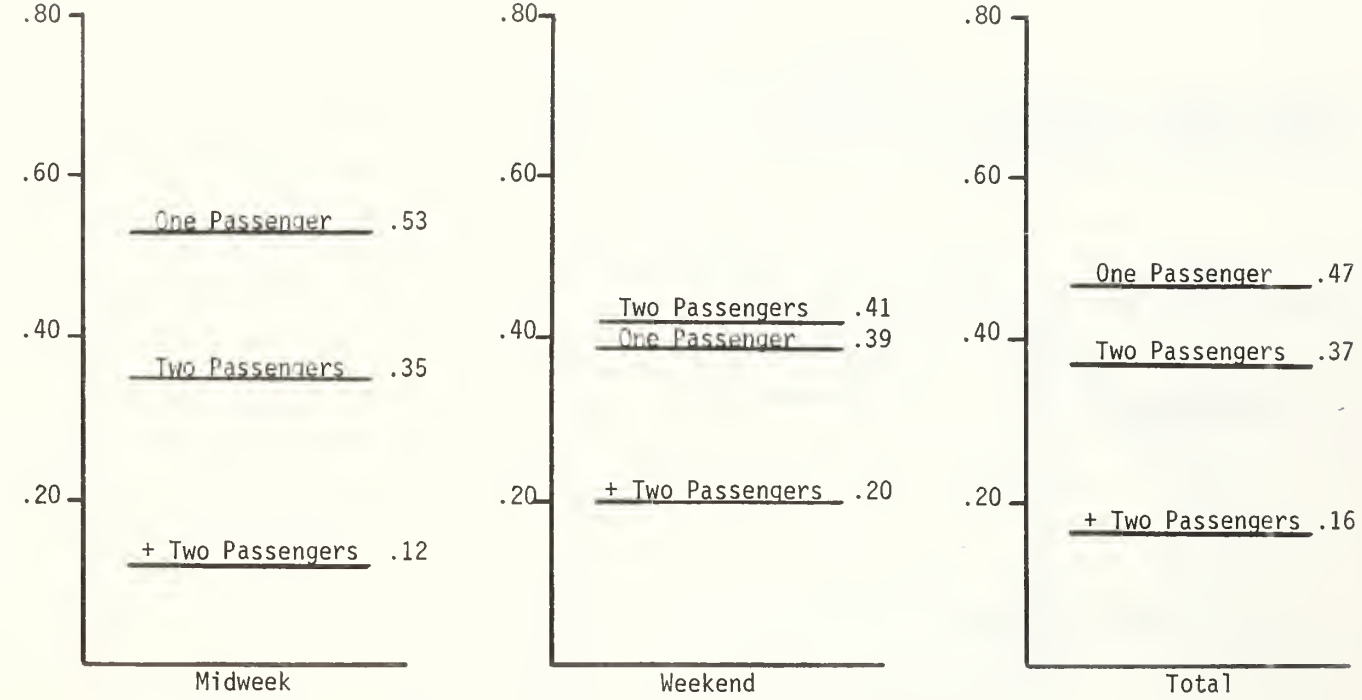
KALISPELL AREA: Weekend Traffic by Hour; STEP Effort.

It may be noted on this chart that the peak traffic occurs between 4 and 5 PM. Another peak occurs between 12 Noon and 1 PM. The lowest hours of traffic are 3 to 5 AM.



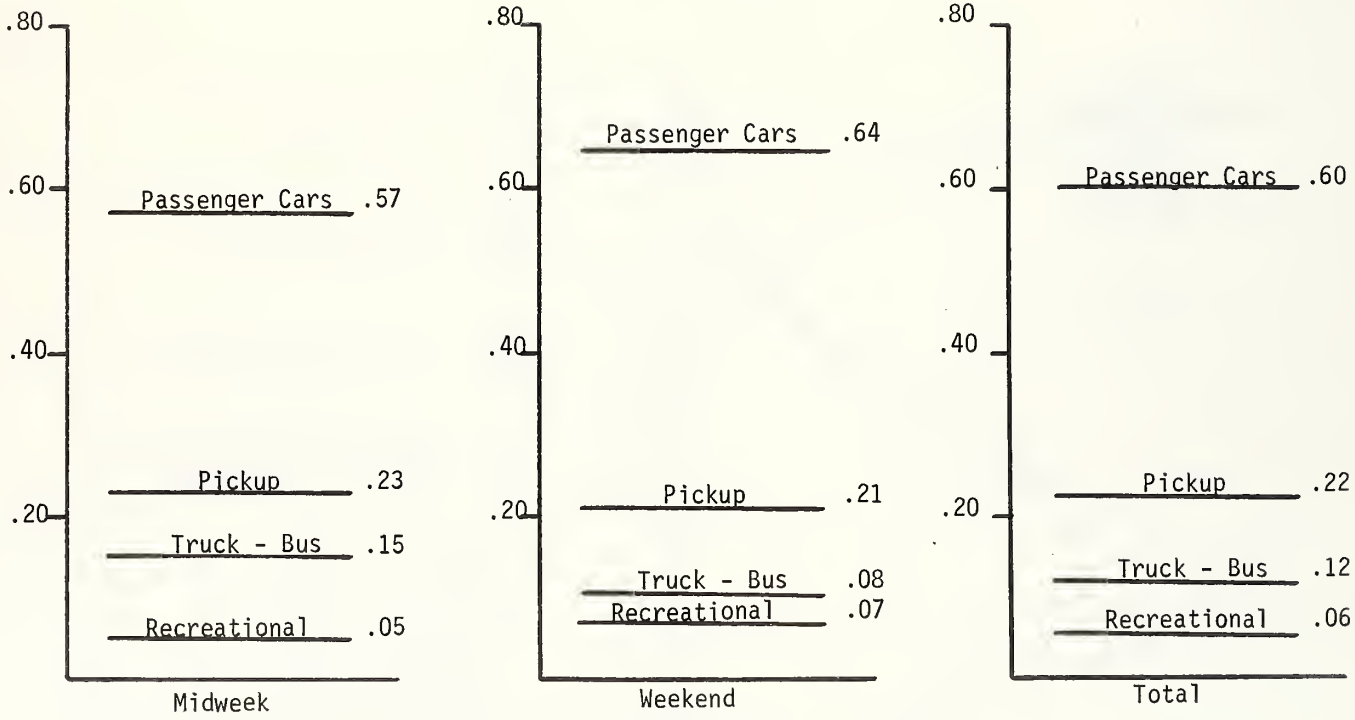
KALISPELL AREA: Sex of Driver by time of Week.

This chart indicates proportions of vehicle drivers, by sex, operating in the Kalispell area during this evaluation period. It may be noted that a slight increase in male drivers occurs on the weekend. These proportions may be compared to sex of driver involved in accidents which is presented in another section of this report.



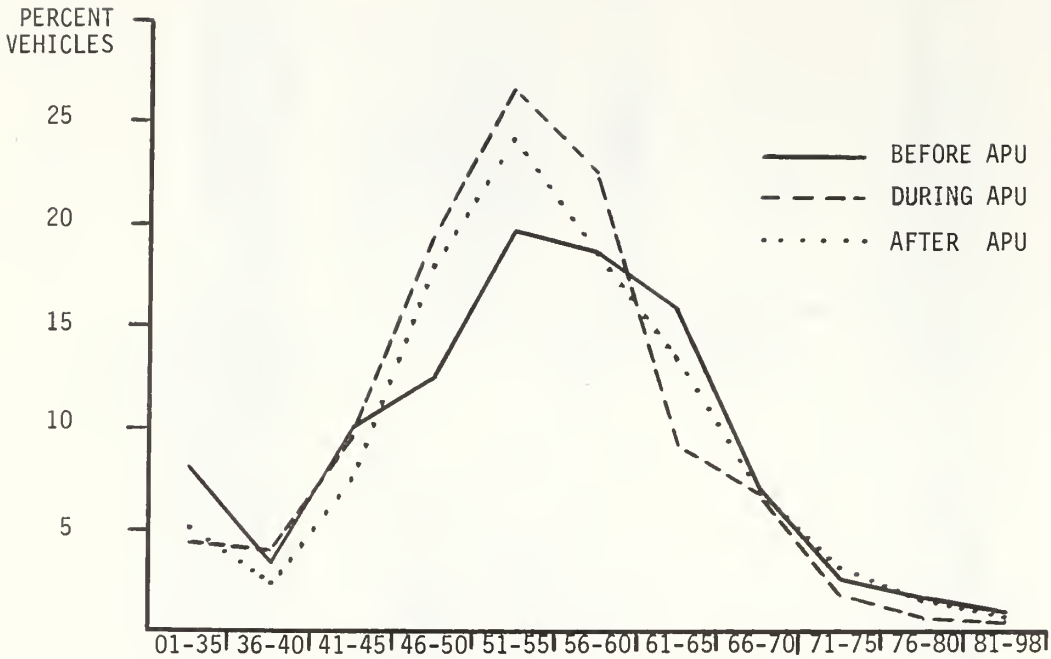
KALISPELL AREA: Number of Passengers per Vehicle by Time of Week.

These charts indicate the proportions of vehicles with a given number of passengers operating in the Kalispell area during this evaluation period. It is interesting to note that if the "greater than two" passengers catagory is assumed to imply 3 passengers; the occupancy rate climbs from 1.59 passengers per vehicle during the week to 1.81 passengers per vehicle on the weekend.



KALISPELL AREA: Vehicle Type Distribution by Time of Week.

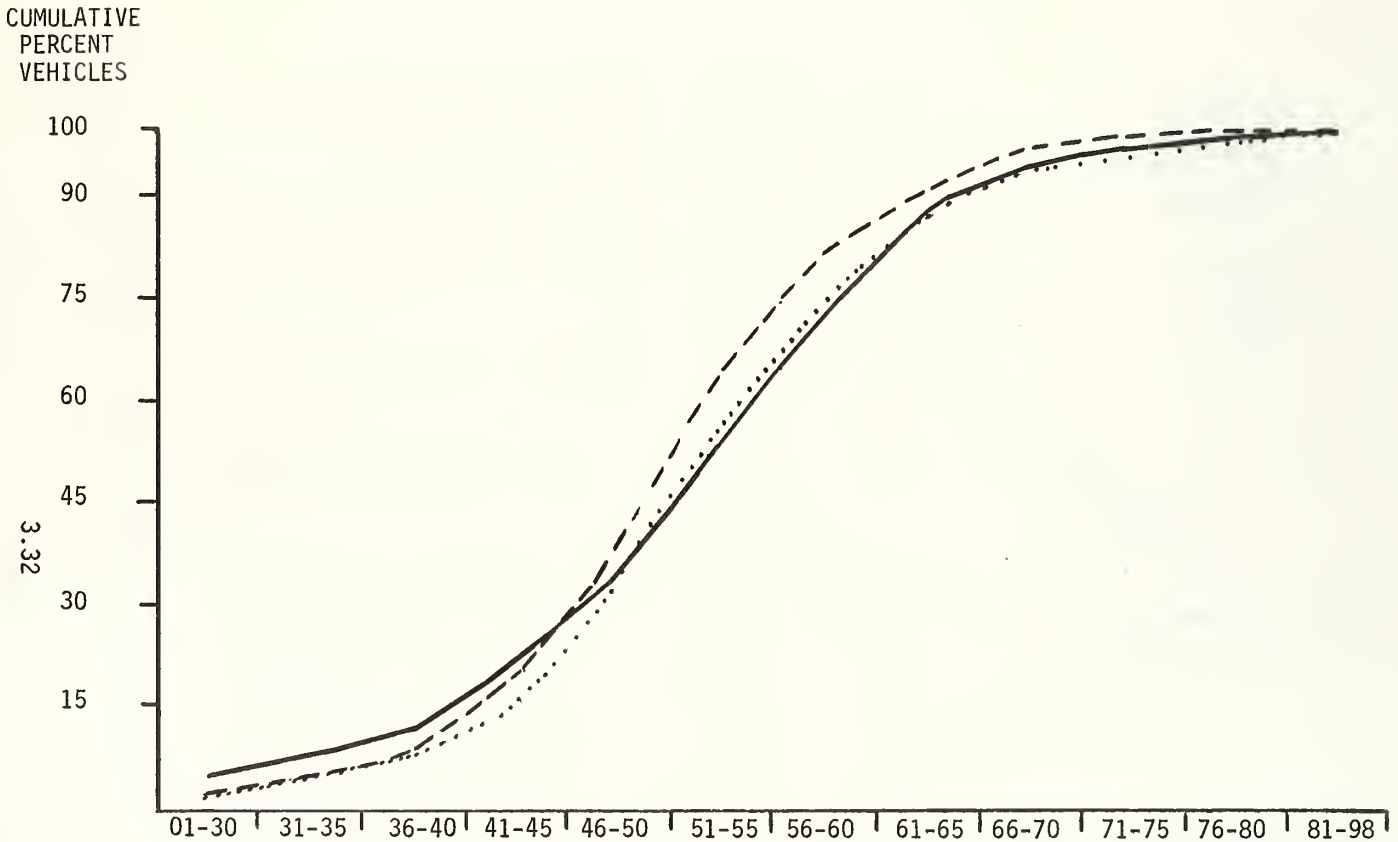
These charts indicate the proportions of vehicles of a given type observed operating in the Kalispell area during this evaluation period. These charts may be compared with those showing accident involvement by vehicle type, found in another section of this report. These charts show a lowering of the proportions of trucks, busses and pickups in the weekend days. Recreational vehicles and passenger cars increase on the weekend.



KALISPELL AREA: Midweek Speed Distribution; STEP Effort.

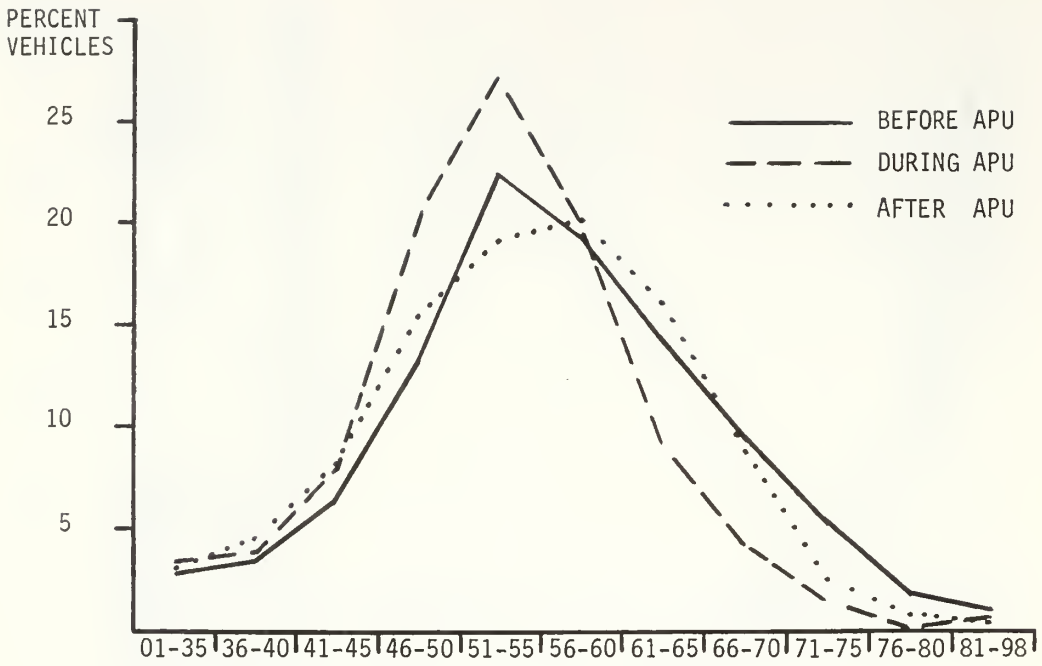
Using a x^2 test; the three distributions shown are found to be dissimilar. The heavy lean to the right of the before distribution (solid line) seems partially corrected by the introduction of the selective enforcement team (APU) into the area.

SPEED GROUP	PERCENT BEFORE APU	PERCENT DURING APU	PERCENT AFTER APU
01-35	8.2	4.4	5.1
36-40	3.4	4.0	2.4
41-45	10.0	9.7	7.4
46-50	12.4	19.2	17.9
51-55	19.7	26.6	23.1
56-60	18.6	17.5	18.4
61-65	15.7	9.0	13.2
66-70	6.9	6.8	6.7
71-75	2.5	1.8	3.0
76-80	1.6	.6	1.8
81-98	1.0	.4	1.0



KALISPELL AREA: Midweek Speed Distribution; STEP Effort.

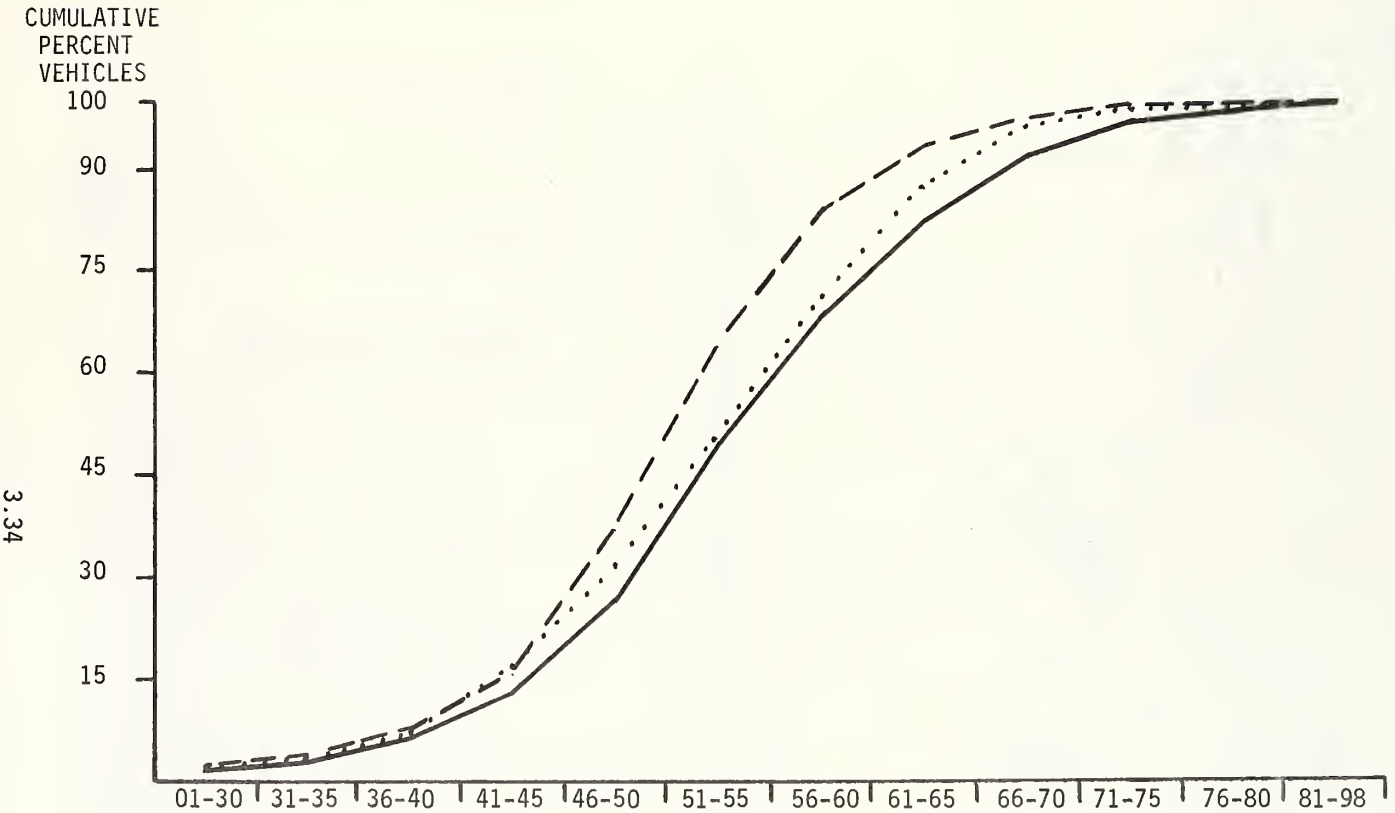
Note that the 85th percentile of speed was reduced from approximately 62 to 58 mph during the APU activity but returned to the same speed following the APU period .



KALISPELL AREA: Weekend Speed Distribution; STEP Effort.

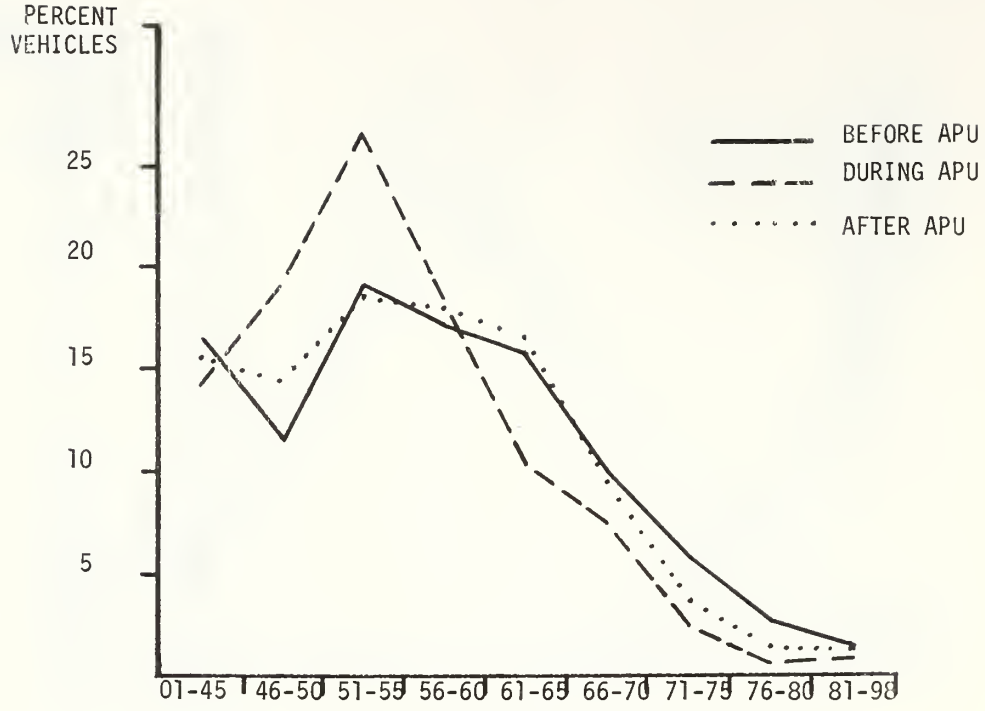
Using a χ^2 test; the three distributions shown are found to be dissimilar. During the enforcement (dash line) can be recognized as a "better" speed distribution, from a traffic safety and movement viewpoint, than before or after distributions. It appears that the after (dot line) speed distribution tends to return to the before (solid line) speed distribution.

SPEED GROUP	PERCENT BEFORE APU	PERCENT DURING APU	PERCENT AFTER APU
01-35	3.0	3.5	3.3
36-40	3.5	4.0	4.7
41-45	6.7	8.1	8.3
46-50	13.3	20.8	15.4
51-55	22.5	27.2	19.1
56-60	19.3	20.2	20.2
61-65	14.1	9.3	16.1
66-70	9.2	4.3	8.9
71-75	5.2	1.7	2.6
76-80	1.9	0.0	0.9
81-98	1.3	0.9	0.5



KALISPELL AREA: Weekend Speed Distribution; STEP Effort.

The 85th percentile of speeds was approximately 64 before APU, 57 during APU and returned to 62 following the special enforcement period.



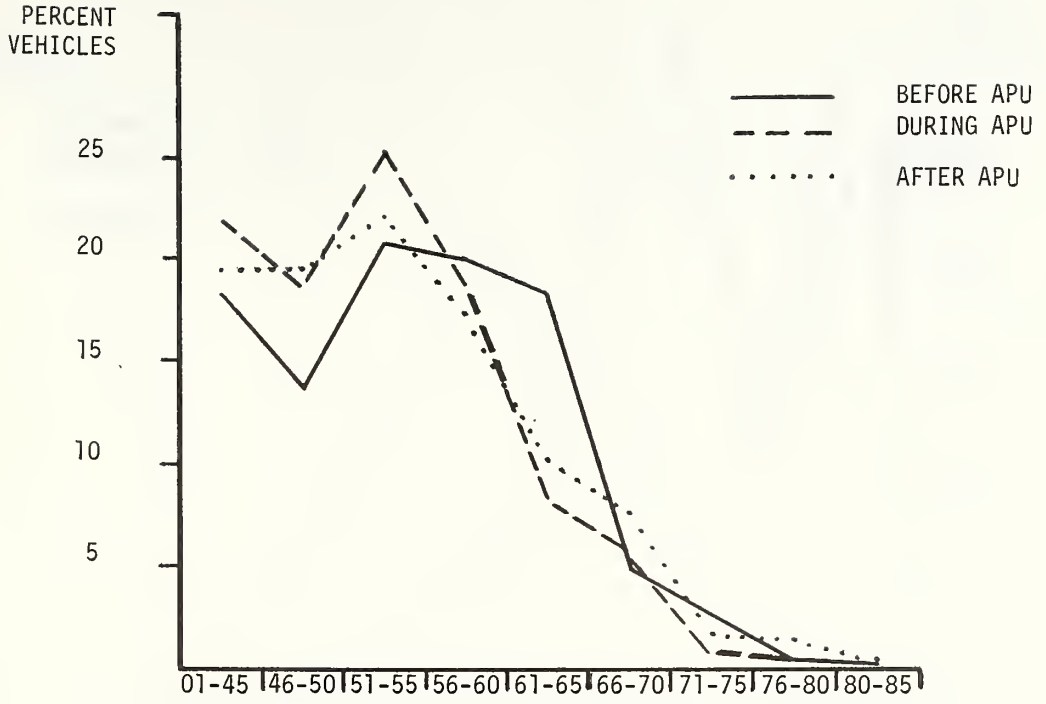
KALISPELL AREA: Speed Distribution by Percent of Passenger Cars.

Using a Chi-Square test the before and after distributions are found to be similar indicating no long carry-over in the affect of the APU in speeds of passenger cars. The calculated Chi-Square statistic has a value of 13.61 yielding a probability of .092.

Also tested was the distribution resulting during the APU activity in the area. Results indicate the APU did affect passenger car speeds while in the area.

SPEED GROUP	PERCENT BEFORE APU	PERCENT DURING APU	PERCENT AFTER APU
01-45	16.6	14.2	15.6
46-50	11.5	19.0	14.5
51-55	19.1	26.6	18.8
56-60	17.1	18.5	18.1
61-65	15.8	10.3	17.6
66-70	9.9	7.5	9.4
71-75	5.8	2.4	3.6
76-80	2.8	0.6	1.3
81-98	1.4	0.9	1.1

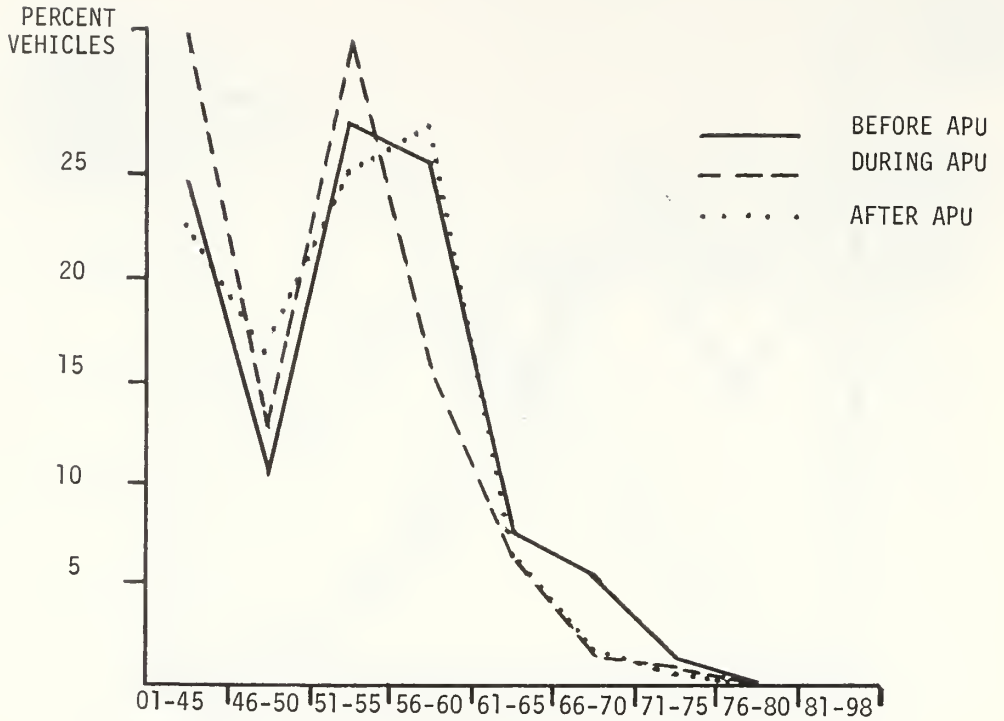
A drop from 10% to 6.0% in the vehicle of passenger cars traveling at speeds in excess of 70 mph was noted from the before to after studies.



KALISPELL AREA: Speed Distribution by Percent of Pickups.

SPEED GROUP	PERCENT BEFORE APU	PERCENT DURING APU	PERCENT AFTER APU
01-45	18.5	21.9	19.4
46-50	13.8	18.8	19.7
51-55	20.9	25.2	22.1
56-60	20.0	19.1	17.3
61-65	18.5	8.3	10.3
66-70	5.0	5.2	7.6
71-75	2.6	0.9	1.8
76-80	0.7	0.3	1.5
81-98	0.0	0.3	0.3

A Chi-Square test, when applied to the three distributions, indicates that the speed distribution of pickups was altered by the use of the selective enforcement unit (APU) and remained at the lower level after the unit had concluded its enforcement period. The calculated Chi-Square statistic is 7.47 yielding a probability of .4872 when the during and after distribution are compared.

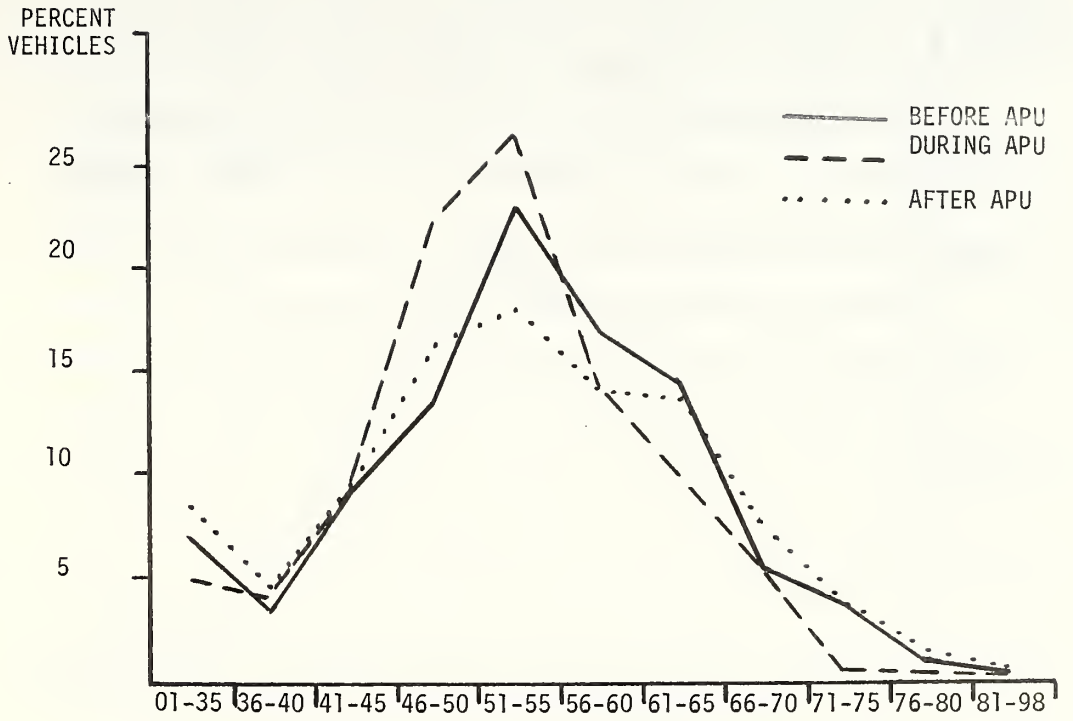


KALISPELL AREA: Speed Distribution by Percent of Trucks.

A Chi-Square test reveals that there may be no significant difference between the three distributions. The value of the Chi-Square statistic is 16.19 yielding a probability of .4400.

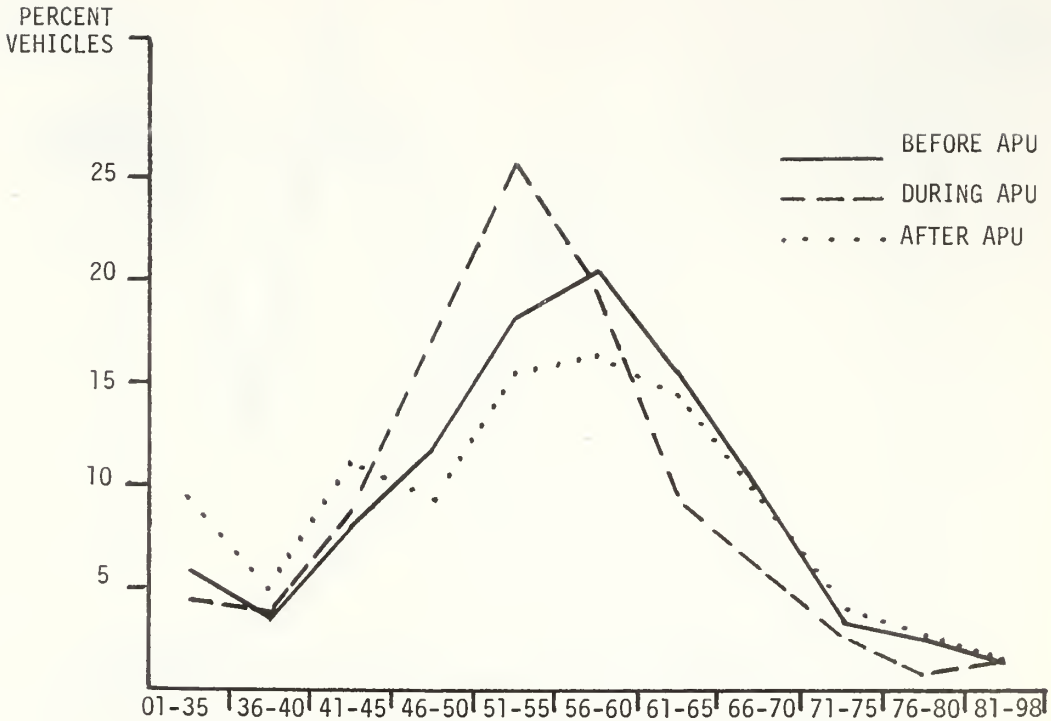
SPEED GROUP	PERCENT BEFORE APU	PERCENT DURING APU	PERCENT AFTER APU
01-45	24.8	31.8	22.6
46-50	12.4	12.6	16.1
51-55	27.6	31.3	25.0
56-60	20.7	15.6	27.4
61-65	7.6	6.2	6.5
66-70	5.5	1.5	1.6
71-75	1.4	1.0	0.8
76-80	0.0	0.0	0.0
81-98	0.0	0.0	0.0

These results indicate that overall truck speeds were not affected by selective enforcement in the Kalispell area. However, the percent of trucks traveling above 65 mph was reduced from 6.9% before the APU activity to 2.5% and 2.4% during and after APU activity respectively. This result indicates a possible carry-over effect at speeds above the legal limit.



KALISPELL AREA: Speed Distribution; Local Flathead County Vehicles

This chart indicates that while the APU was active in the Kalispell area, local vehicle speeds were reduced in the over 60 mile per hour category. After the unit had left the area, the speed distribution tended toward the original before distribution.



KALISPELL AREA: Speed Distribution; Non-Local Vehicles

This chart indicates the effect of concentrated enforcement on speeds of non-local vehicles. Before introduction of the APU into the Kalispell area, the Orbis information indicates that speeds were higher than those shown while concentrated enforcement was active. After the end of the APU effort, speeds tended to return to the original state. This is to be expected since non-local vehicles traveling in the area after selective enforcement would not be expected to be aware of that enforcement.

Public Opinion Questionnaire

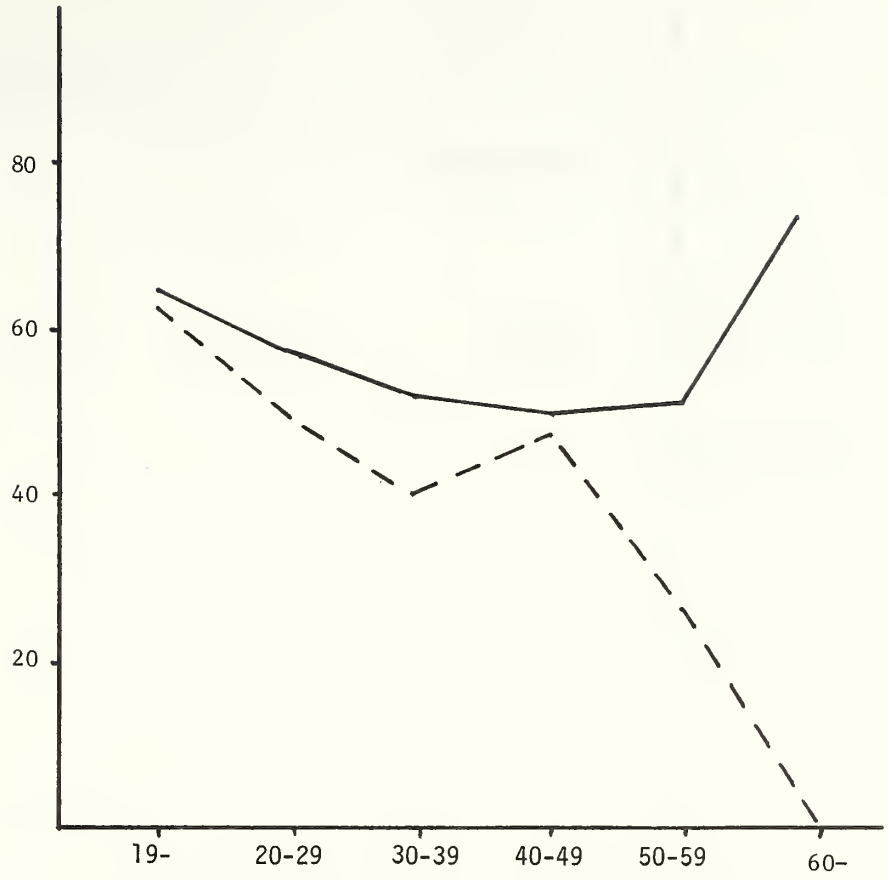
A public opinion survey was conducted in both Billings and Kalispell. A representative sample of the driving public was obtained by administering the questionnaires to all persons renewing their Montana drivers license at the driver examination stations in these cities.

This sampling technique was invented and developed during the initial stages of this evaluation by the Montana Highway Safety Office Statistician and the special statistical consultant involved in the project. This technique has a number of advantages over alternative survey methods. It directly reaches the driving public and automatically gives a random selection by age, sex, occupation, driving habits and history, and by socio-economic level. The response rate is nearly 100% and the time period required to conduct the survey is minimized. Costs are extremely low as compared to any other survey method and since the questionnaires were not given until after the entire licensing procedure was completed, drivers were assured that their survey response would not effect the issuance of their license.

Approximately 500 questionnaires were used in Billings and 360 were completed in Kalispell, requiring less than 15 days time. General topics covered include accident causal factors, driver behavior characteristics, public awareness of and attitude towards the accident prevention unit and unsafe driving practices and enforcement priorities.

Other alternative survey methods considered include a mail out

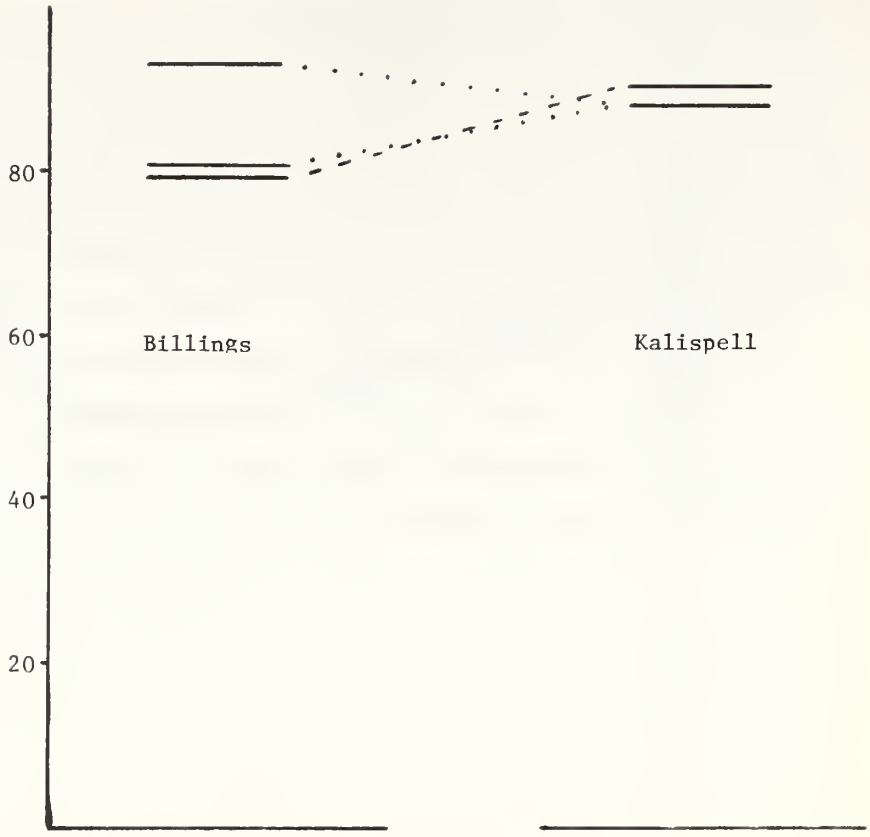
questionnaire which was rejected due to the low response rate, roadside interviews were rejected because of the safety problems in administering them and the expense involved, house to house interviews were not used because of the expense involved and problems in selecting a representative sample, and a newspaper questionnaire was not used because respondents tend to have extreme viewpoints. The most attractive alternative survey method considered involved administering the questionnaire to specially selected groups and organizations in order to give a representative cross section of the community; this method was rejected because there were more administrative difficulties and costs were higher than was the case with the driver examiner method.



PERCENT OF DRIVERS AWARE OF THE ACCIDENT PREVENTION UNIT ACTIVITY BY AGE

Younger drivers were more aware of the APU than older persons, except that in Billings those over 60 indicated very high awareness due to news coverage.

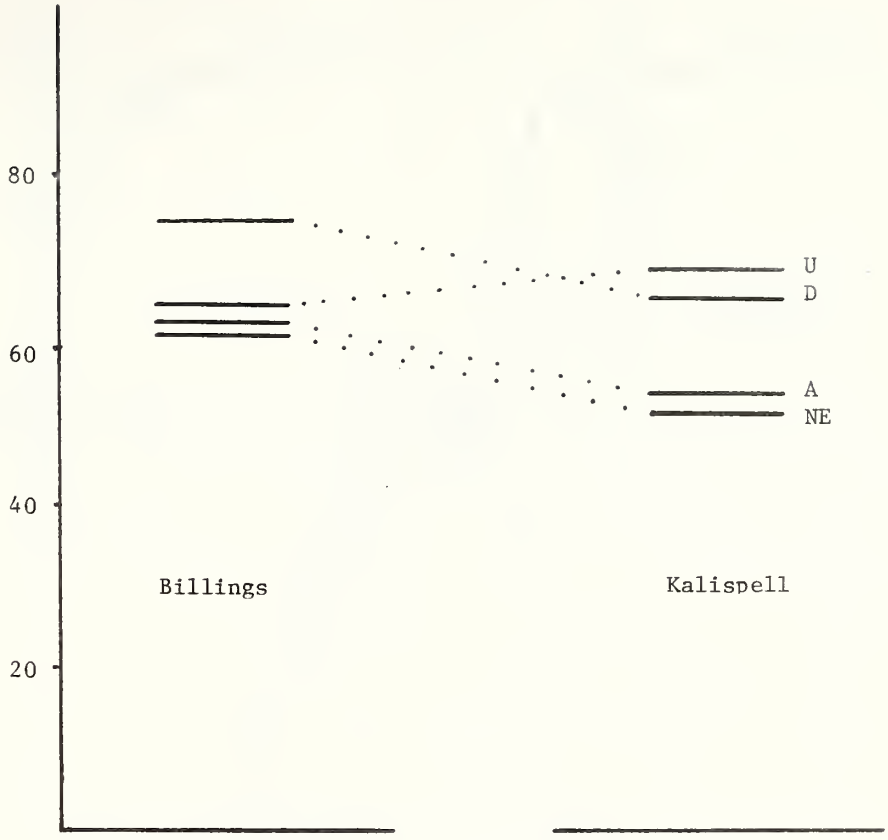
Age	Billings	Kalispell
-19	65.2	63.2
20-29	57.9	50.0
30-39	52.3	41.0
40-49	49.2	48.1
50-59	51.5	26.3
60-	76.5	0.0
Overall	56.8	47.6



PUBLIC AWARENESS OF THE ACCIDENT PREVENTION UNIT

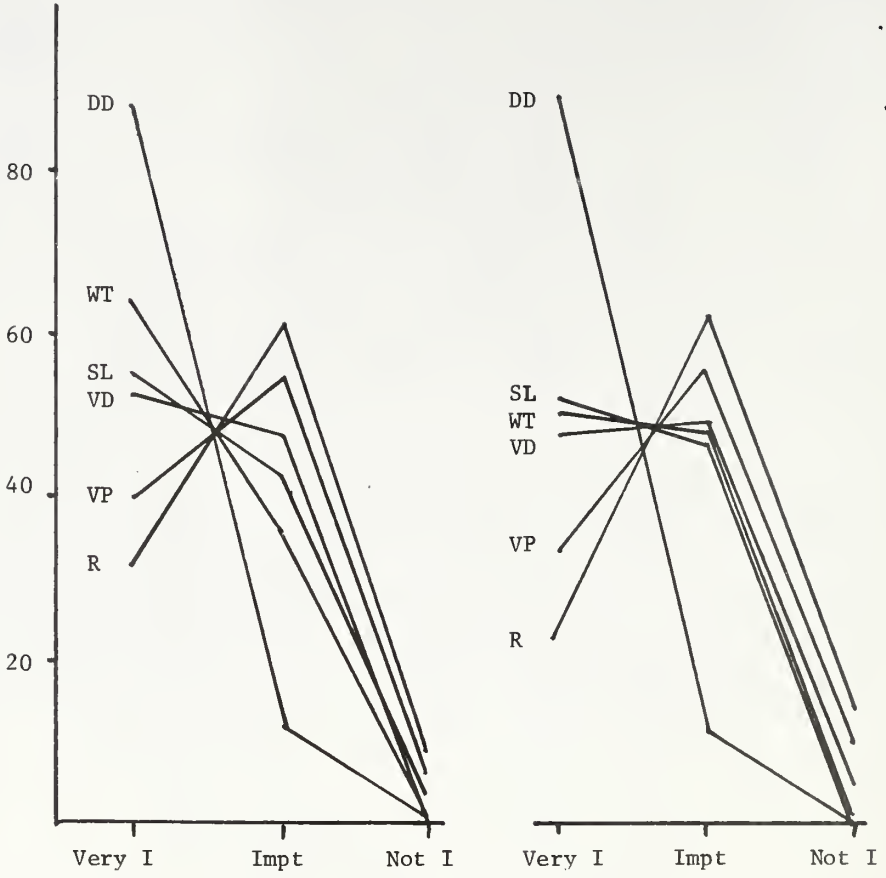
	Billings	Kalispell
Those who saw it in action	93%	88%
Those who read of it in newspapers	81%	88%
Those who heard of it on radio or TV	79%	90%

There seems to be very little difference in the ways people learn of the APU except that radio and TV coverage was more effective in Kalispell. Data reported above pertains to those persons aware of the presence of the APU, overall the driving public had only an approximate 60-70% exposure to the APU through news media.



PUBLIC OPINION OF APU EFFECTIVENESS

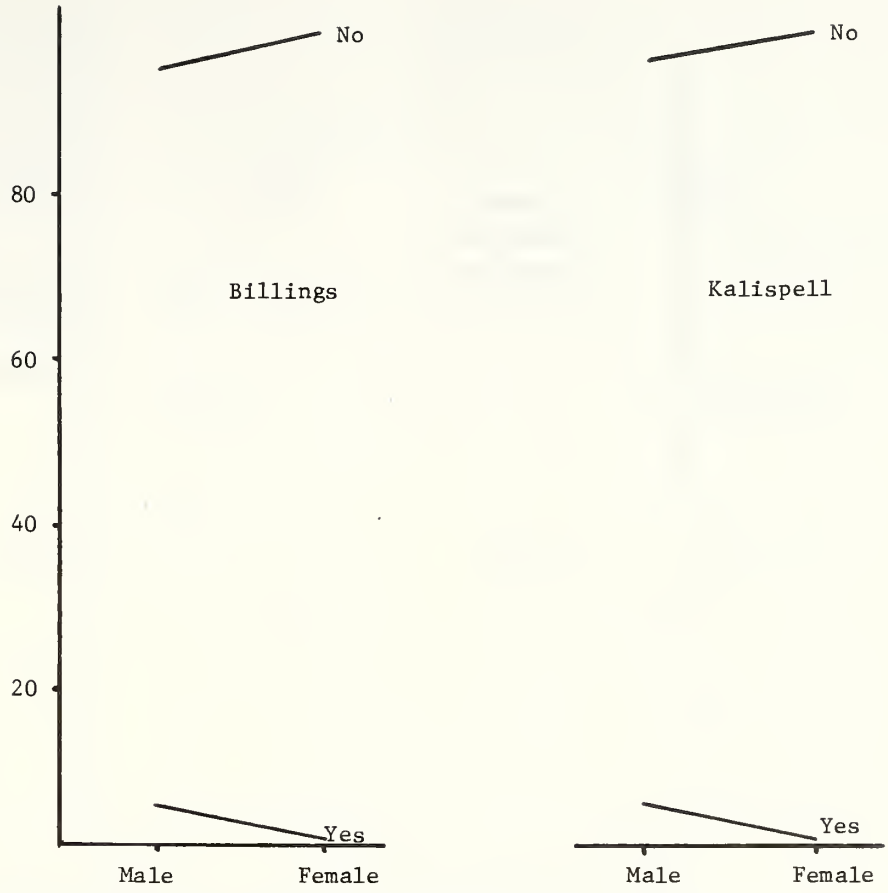
	Billings	Kalispell
Reduced drinking driving (D)	74 %	64 %
News coverage reduced unsafe driving (U)	64 %	68 %
More alert to unsafe driving (A)	62 %	53 %
Drivers were not educated (NE)	60 %	50 %



PUBLIC PERCEPTION OF THE IMPORTANCE OF LAW ENFORCEMENT ACTIVITIES

	Billings			Kalispell		
	VI	I	NI	VI	I	NI
Enforcing Speed Laws (SL)	54.8	41.9	3.3	52.3	46.7	1.0
Apprehending Drinking Drivers (DD)	87.9	11.9	0.2	88.6	11.4	0.0
Roadblocks for Unlicensed Drivers (R)	30.7	60.5	8.8	23.9	61.9	14.2
Giving of Warning Tickets (WT)	63.5	35.1	1.4	51.0	47.7	1.3
Warning of Vehicle Defects (VD)	52.7	47.3	0.0	47.2	48.4	4.4
Maintaining Visible Patrol (VP)	39.6	54.6	5.8	33.3	55.8	10.9

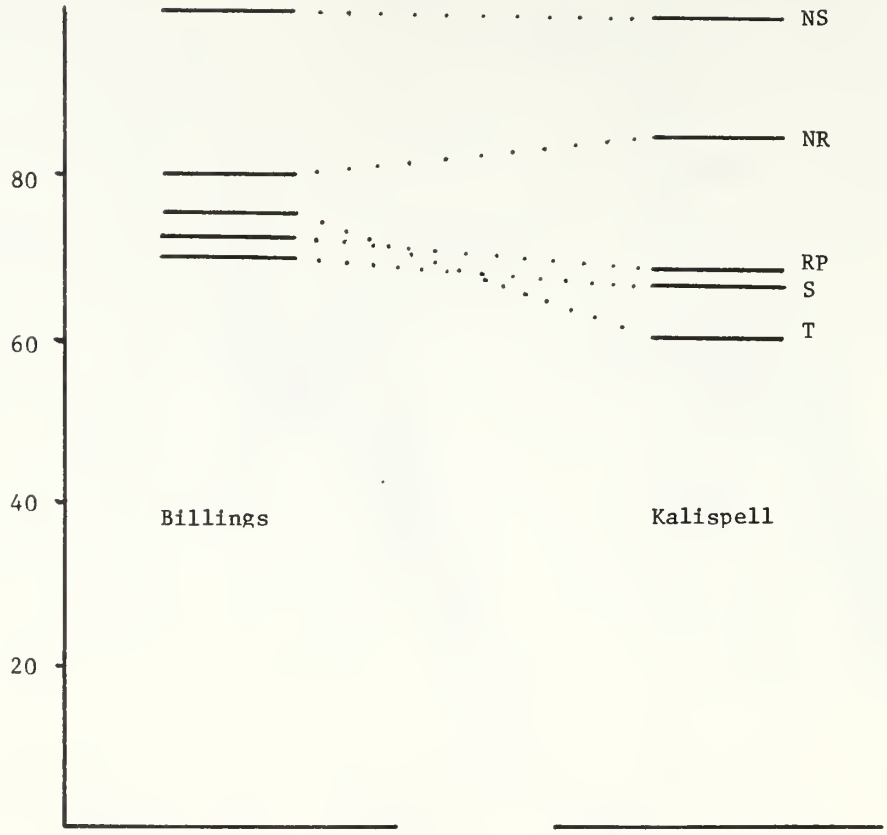
This data is presented to demonstrate the similarity of the two areas and to indicate the public rating of importance of law enforcement activities.



PUBLIC RESPONSE TO "DO YOU FEEL THE HIGHWAY PATROL IS TOO STRICT?"

Approximately 97% of the overall population of drivers in the two communities feel that traffic law enforcement is <u>not</u> too strict.

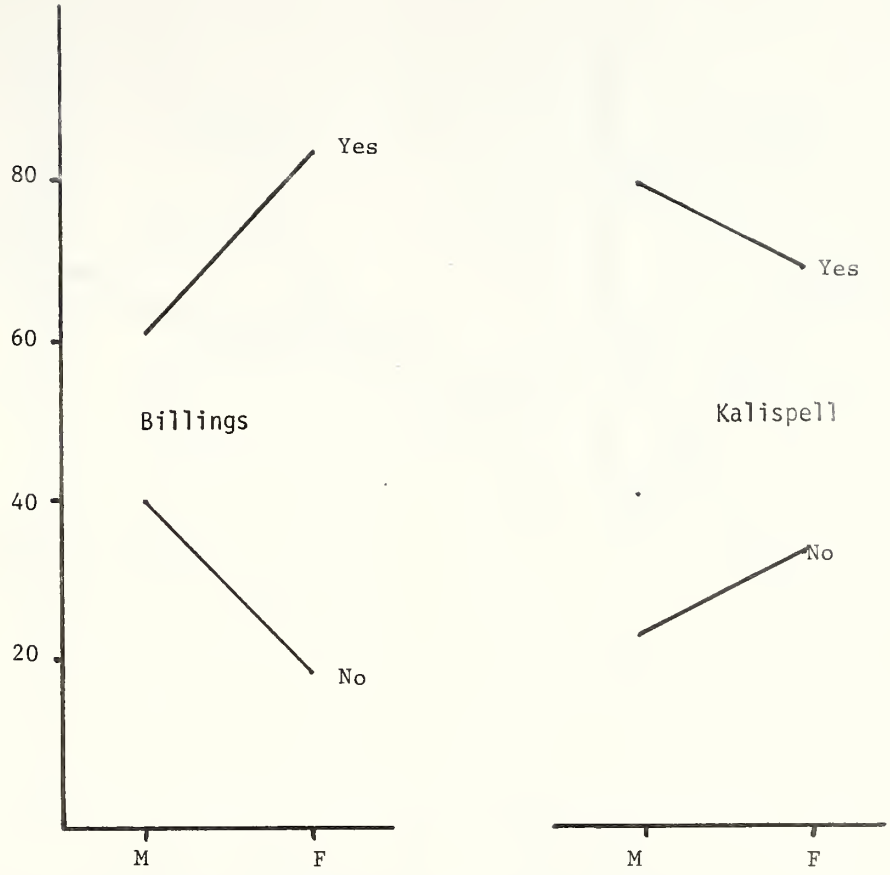
	Billings		Kalispell	
	Yes	No	Yes	No
Male	4.5	95.5	4.2	95.8
Female	1.0	99.0	1.3	98.7
Overall	3.1	96.9	2.9	97.1



PUBLIC ATTITUDE TOWARDS LAW ENFORCEMENT: Persons Aware of APU

	Billings	Kalispell
Enforcement not too strict (NS)	100%	99%
Prefer only regular patrol (RP)	72%	68%
Felt threatened by patrol (T)	75%	60%
Prefer APU not return regularly (NR)	80%	84%
Felt more safe with APU present (S)	70%	66%

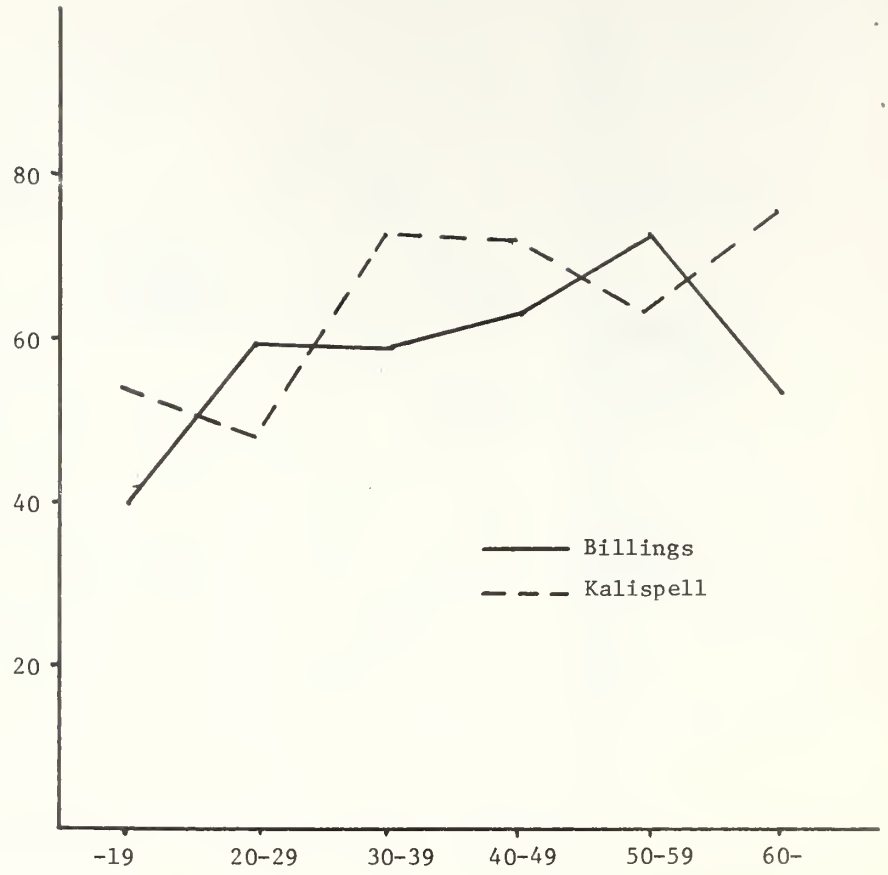
A definite conflict of values is illustrated by the responses to feeling threatened and not wanting APU to return as compared to feeling more safe with the APU present and nearly everyone who was aware of the APU feeling that enforcement was not too strict.



PERCENTAGE OF PUBLIC THAT PREFER ONLY REGULAR LOCAL PATROL.

Note that in Billings, more females than males prefer regular patrol while drivers in Kalispell are reversed in preference.

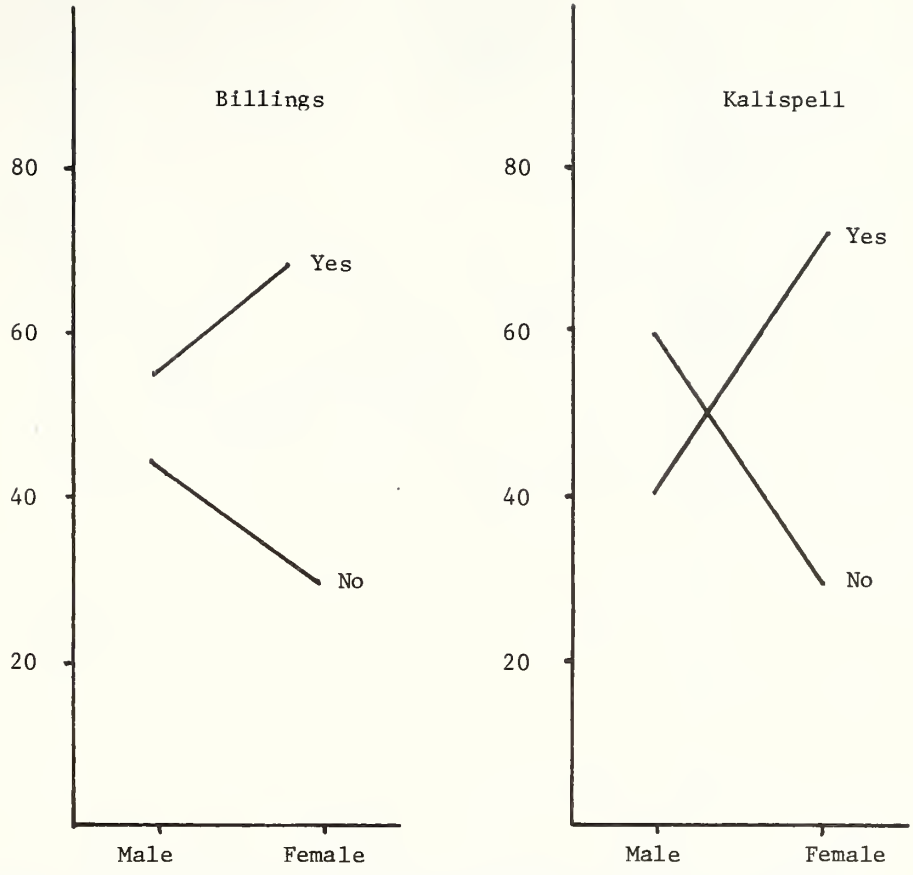
	Billings		Kalispell	
	Yes	No	Yes	No
Male	77.4	22.6	60.0	40.0
Female	67.3	32.7	81.7	18.3
Overall	72.5	27.5	68.7	31.3



PERCENTAGE OF RESPONDENTS THAT DESIRE ADDITIONAL PERMANENT PATROLMEN, BY AGE

The two locations are quite similar and the desire for additional patrolmen increases with age. An overall 60% of the driving public would desire more law enforcement.

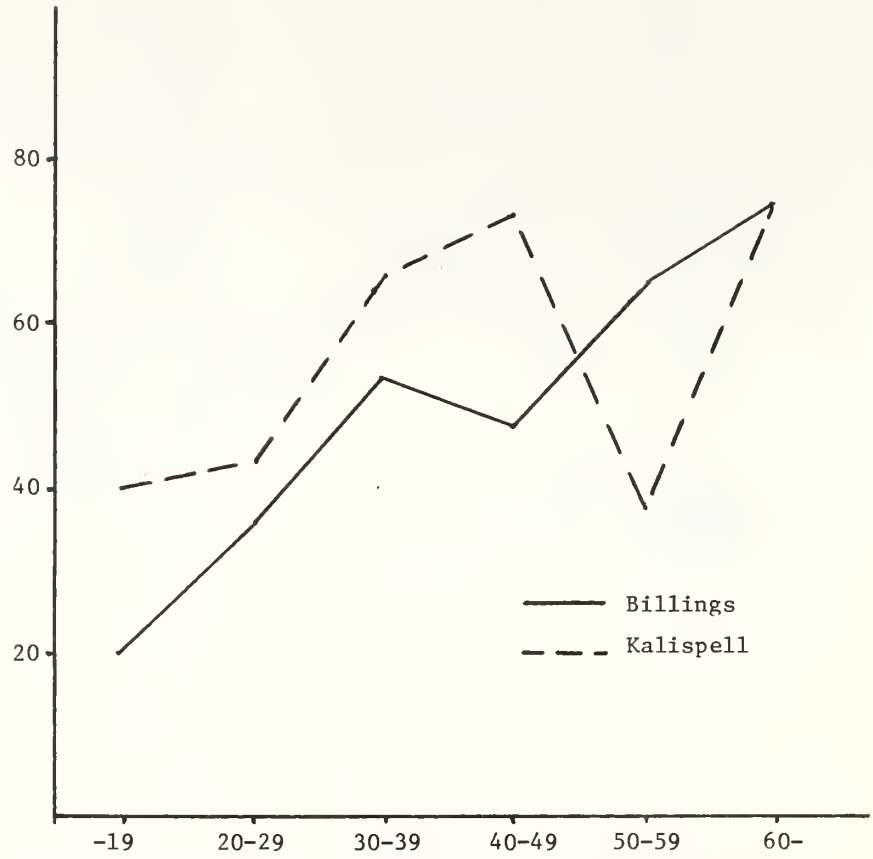
Age	Billings	Kalispell
-19	40.0	53.6
20-29	59.3	47.1
30-39	58.1	72.1
40-49	62.9	71.9
50-59	73.3	62.5
60-	53.8	75.0
overall	62.4	57.7



PERCENTAGE OF PUBLIC THAT FEEL SAFE WHEN HIGHWAY PATROL IS VISIBLE

Women definitely feel safer when a patrol car is in the area, while male reaction depends on the city. This attitude probably depends on driving habits.

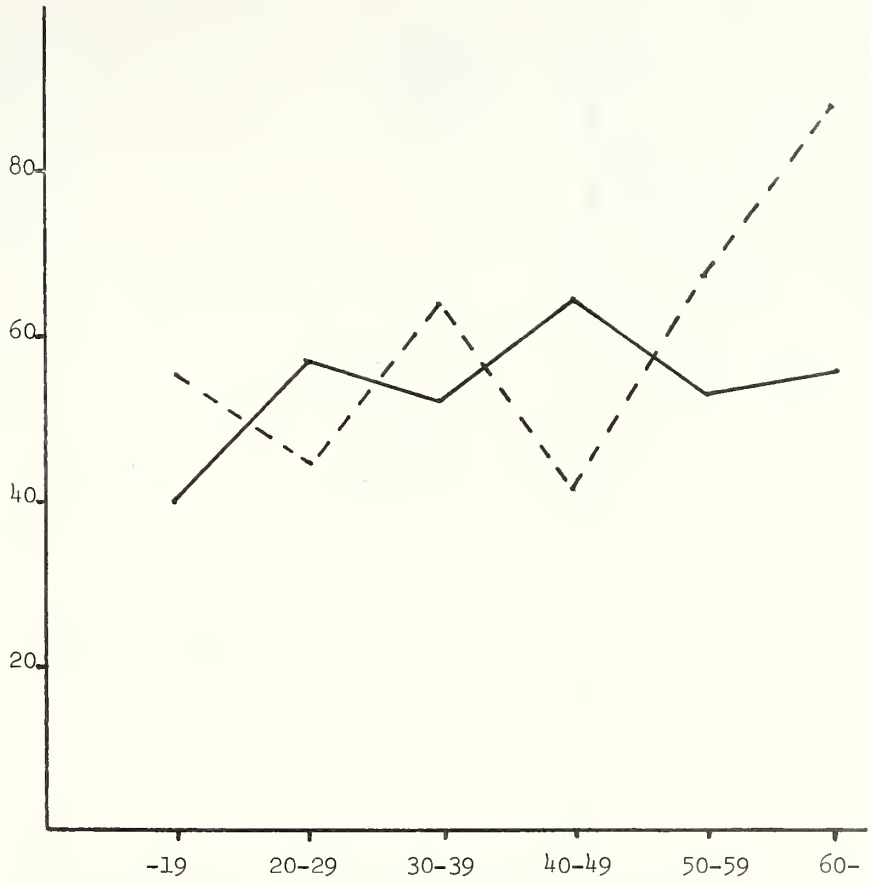
	Billings		Kalispell	
	Yes	No	Yes	No
Male	55.1	44.9	40.1	59.9
Female	70.5	29.5	70.5	29.5
Overall	61.3	38.7	53.8	46.2



PERCENTAGE OF DRIVING PUBLIC THAT WOULD FAVOR MORE STRICT COURT PENALITIES, BY AGE

Generally older persons would tend to favor more strict court penalities. The low response from drivers in their 50's in Kalispell is believed to be a data outlier and is probably not representative of the population.

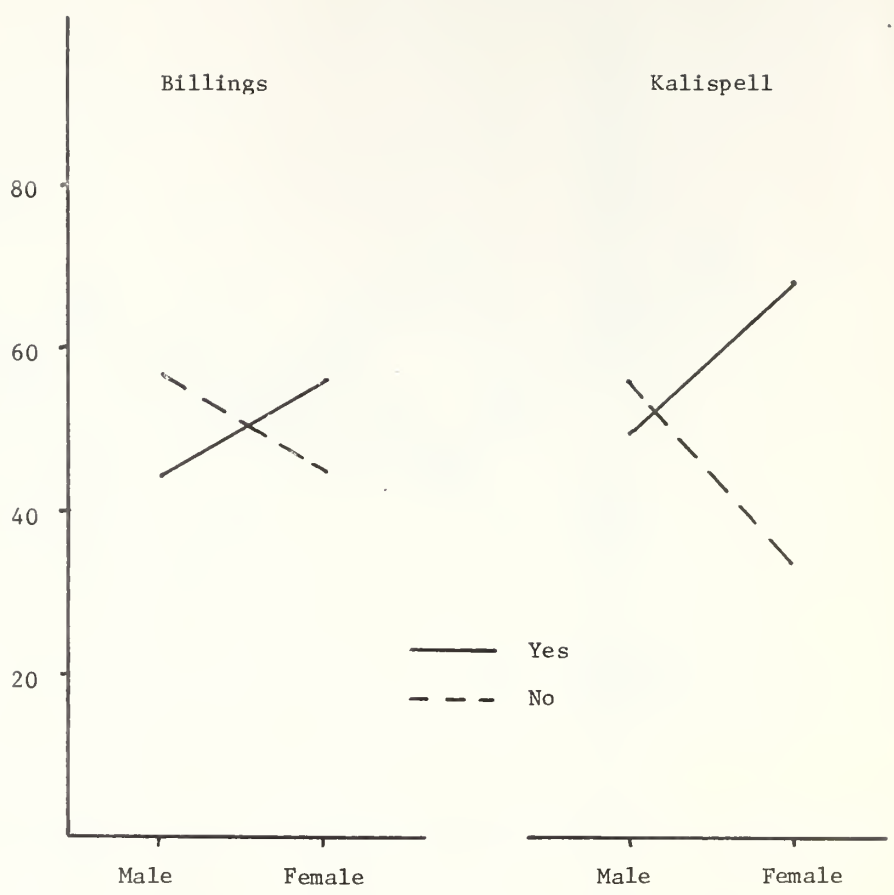
Age	Billings	Kalispell
-19	19.4	40.0
20-29	34.8	42.9
30-39	53.7	65.8
40-49	47.4	73.5
50-59	64.3	37.5
60-	75.0	75.0
Overall	41.6	55.7



RECOGNITION OF SPEEDING AS A HIGH ACCIDENT CAUSE, as reported on public questionnaire

Note that teenage drivers in Billings do not identify speeding as a high accident cause as frequently as older drivers in the area. In Kalispell, the data has much more inherent variation and no similar conclusion may be drawn regarding persons in their 20's and 40's.

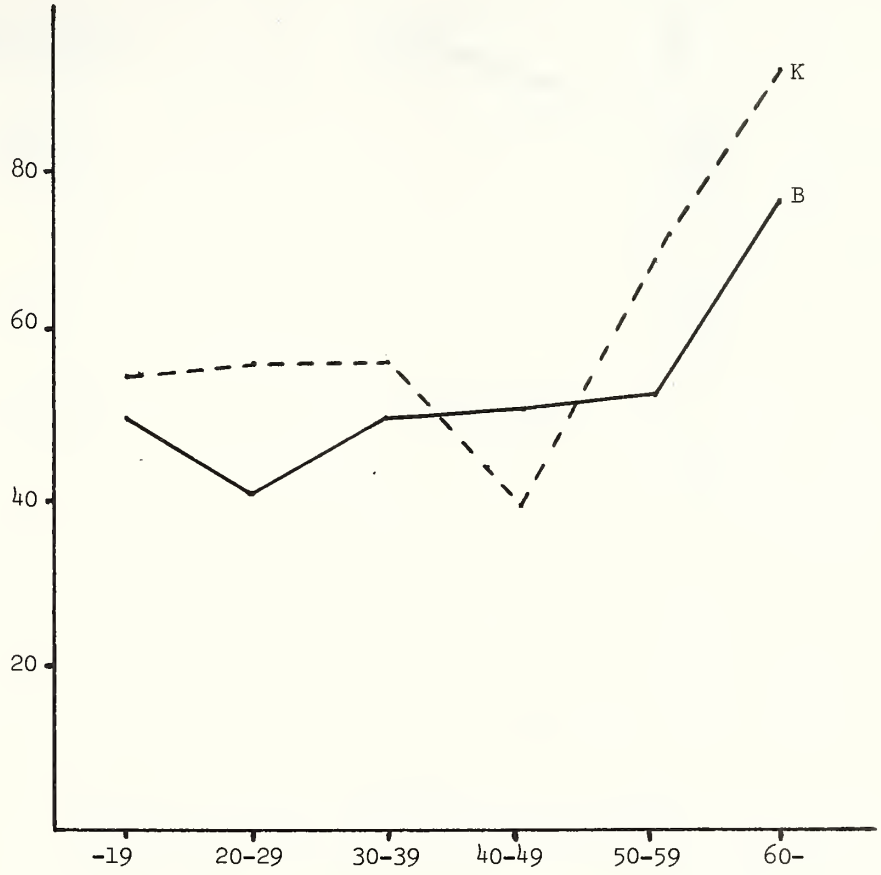
Age	Billings	Kalispell
-19	41	55
20	57	44
30	52	64
40	64	41
50	53	67
60-	55	88



PERCENT OF PERSONS FAVORING A DAYTIME SPEED LIMIT, BY SEX

More females than males favor a daytime speed limit. Overall persons in Kalispell slightly favor a speed limit while persons in Billings are slightly opposed.

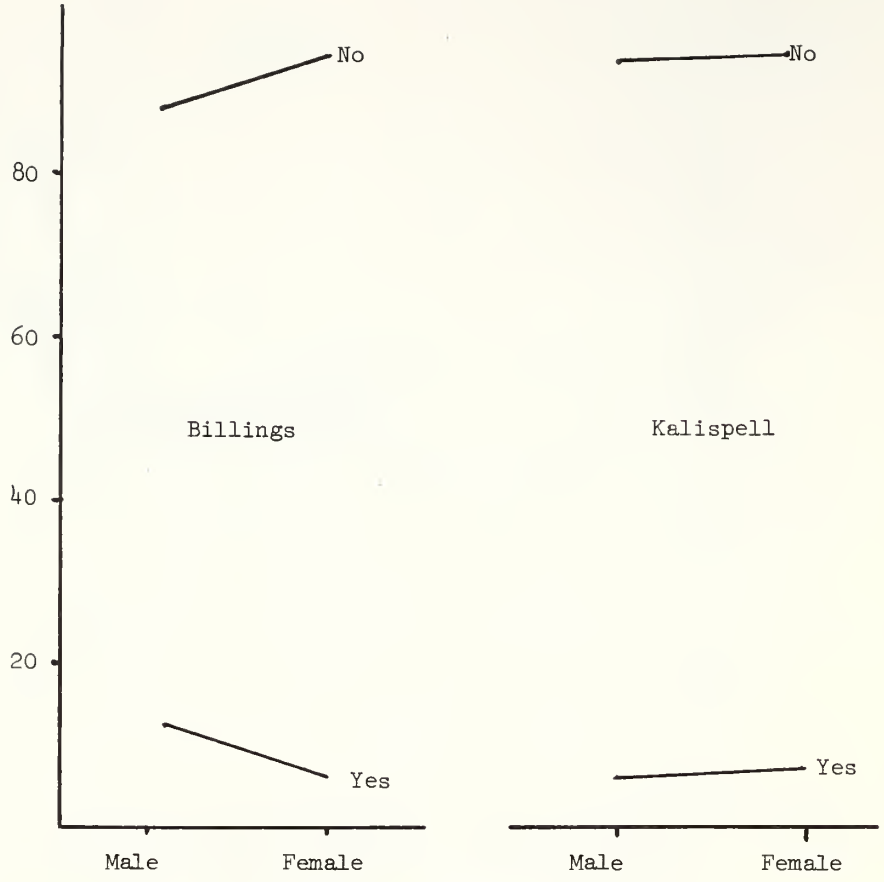
	Billings		Kalispell	
	Yes	No	Yes	No
Male	43.9	56.1	45.2	54.8
Female	55.3	44.7	67.3	32.7
Overall	48.6	51.4	55.3	44.7



PERCENTAGE (BY AGE) OF RESPONDENTS WHO FEEL THERE SHOULD BE A DAYTIME SPEED LIMIT

Strong support for a daytime speed limit apparently comes only from persons over 60, and the larger city gives less support than the more rural community.

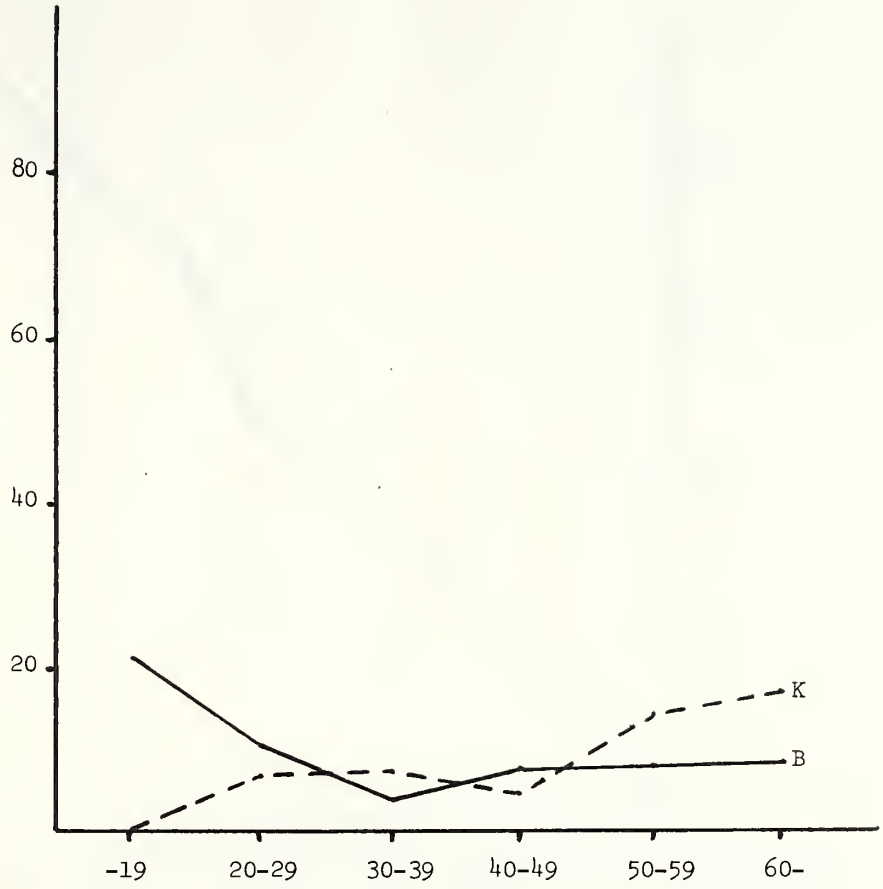
	Billings	Kalispell
-19	49.3	54.5
20-29	41.8	56.6
30-39	50.0	56.8
40-49	50.7	39.0
50-59	52.5	69.6
60-	76.0	91.7
overall	49.1	55.3



PUBLIC RESPONSE TO, "DO YOU FEEL SPEED LIMITS ARE TOO LOW?"

	Billings		Kalispell	
	Yes	No	Yes	No
Male	12.7	87.3	5.9	93.1
Female	6.1	93.9	6.4	93.6
Overall	10.0	90.0	6.1	93.9

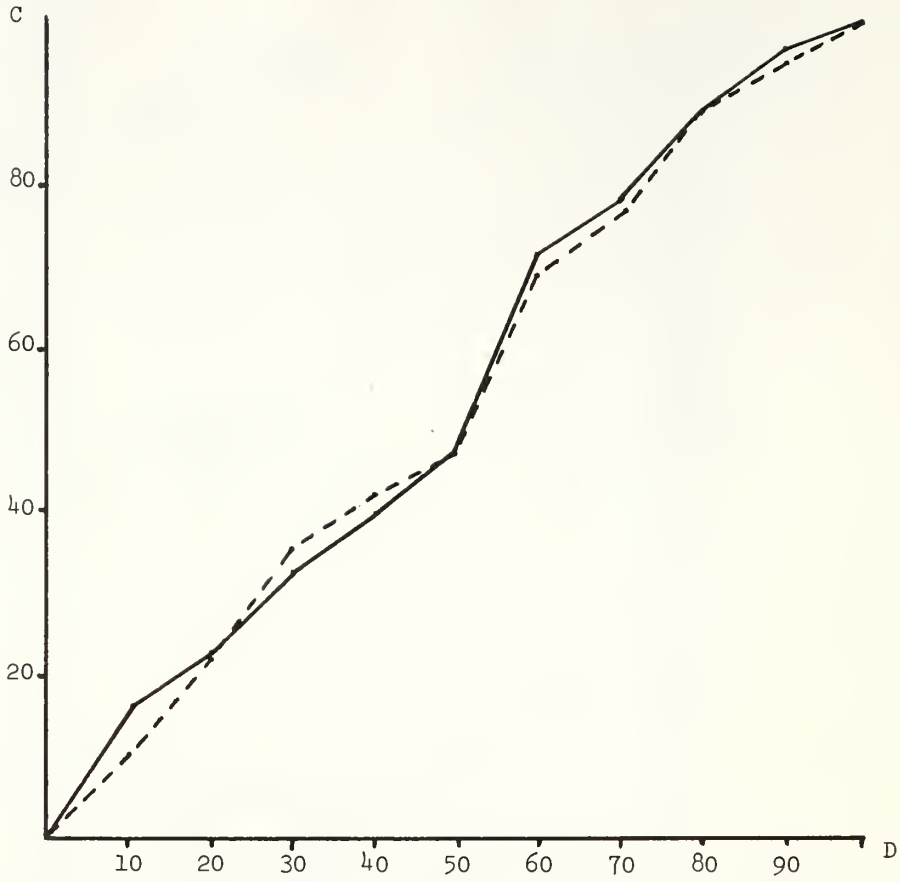
Over 90% of the public feel that speed limits are not too low, and there is no significant difference in responses by sex.



PERCENTAGE (BY AGE) OF RESPONDENTS WHO FEEL SPEED LIMITS ARE TOO LOW

Note that teenagers in the Billings area and persons in their 50's and 60's in the Kalispell area are much more likely to feel speed limits are too low than are persons of other ages. This is not due to inherent variation, but must be explainable in terms of demographic differences which were not considered by this study.

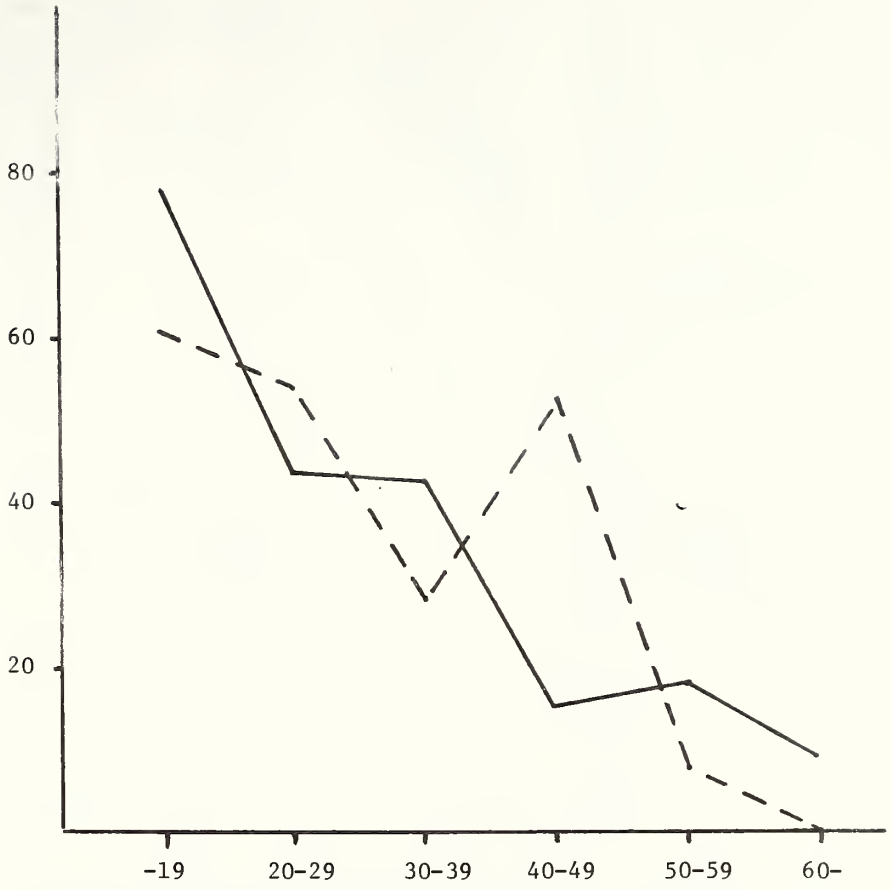
	Billings	Kalispell
-19	21.6	0.0
20-29	10.2	7.0
30-39	4.1	6.7
40-49	6.9	5.1
50-59	7.9	14.3
60-	9.1	16.6
Overall	10.0	6.1



CUMMULATIVE %(C) OF RESPONDENTS WHO FEEL THAT AT LEAST D % OF DRIVERS REGULARLY EXCEED THE SPEED LIMIT

Note that the two locations are very similar, and that 60% of the people feel that at least 55% of the drivers regularly exceed the speed limit.

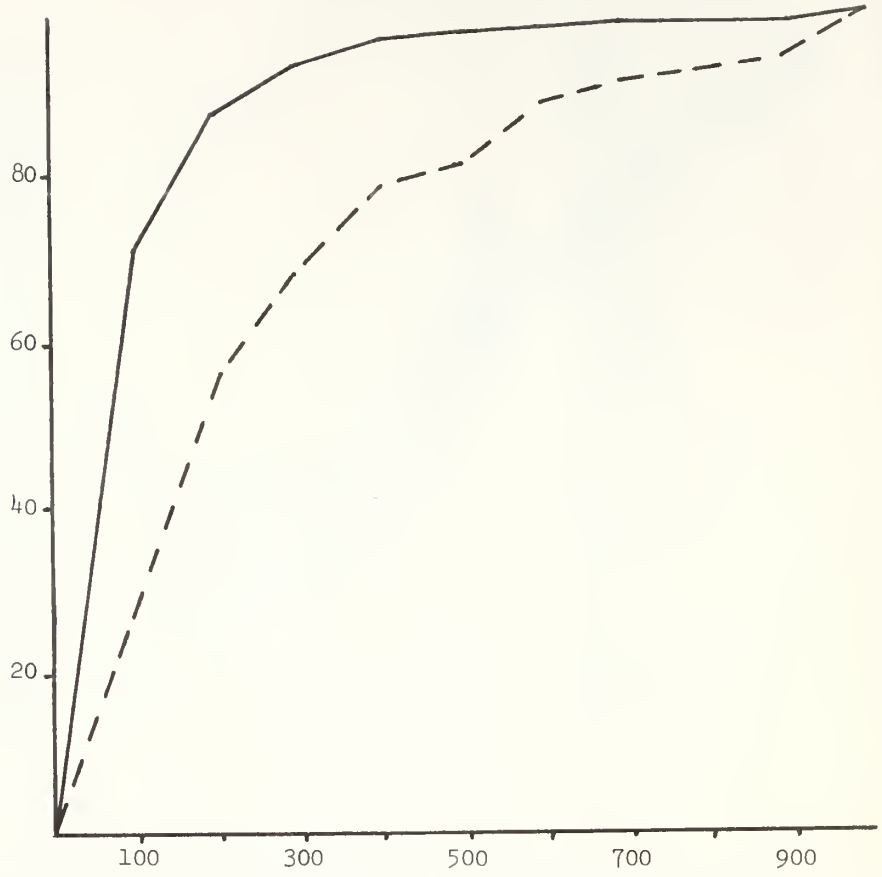
% Who Exceed Speed Limit (D)	Billings	Kalispell
10	15.5	9.9
20	22.1	21.7
30	32.6	35.3
40	38.6	41.8
50	46.5	47.4
60	70.6	69.4
70	77.4	76.2
80	88.7	88.6
90	96.0	94.8
100	100.0	100.0



PERCENTAGE OF RESPONDENTS WHO HAD RECEIVED DRIVER EDUCATION, BY AGE

Apparently a smaller percentage of Kalispell youth are presently receiving driver education than those in the Billings area.

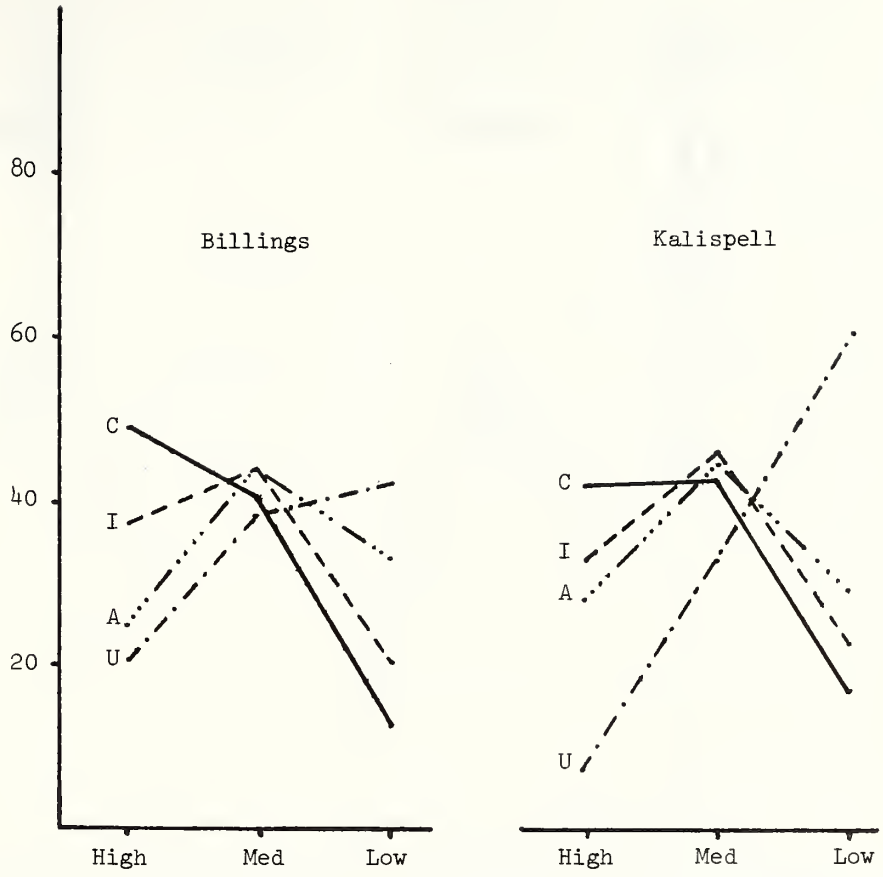
	Billings	Kalispell
-19	78.0	61.3
20-29	43.9	54.1
30-39	42.3	27.9
40-49	15.2	52.2
50-59	17.4	7.7
60-	9.1	0.0
Overall	41.2	43.5



CUMMULATIVE % OF THE POPULATION DRIVING FEWER THAN M MILES/WEEK, BY SEX

The two locations, Billings and Kalispell, were very similar and have been pooled. Over 88% of the female drivers drive less than 200 miles/week, while only 56% of the males drive less than 200 miles/week.

Miles/Week (M)	Males	Females
100	27.4	71.4
200	55.8	88.7
300	68.2	94.0
400	78.8	96.8
500	81.9	97.8
600	89.1	98.6
700	91.7	98.9
800	92.2	98.9
900	94.1	98.3
	100.0	100.0

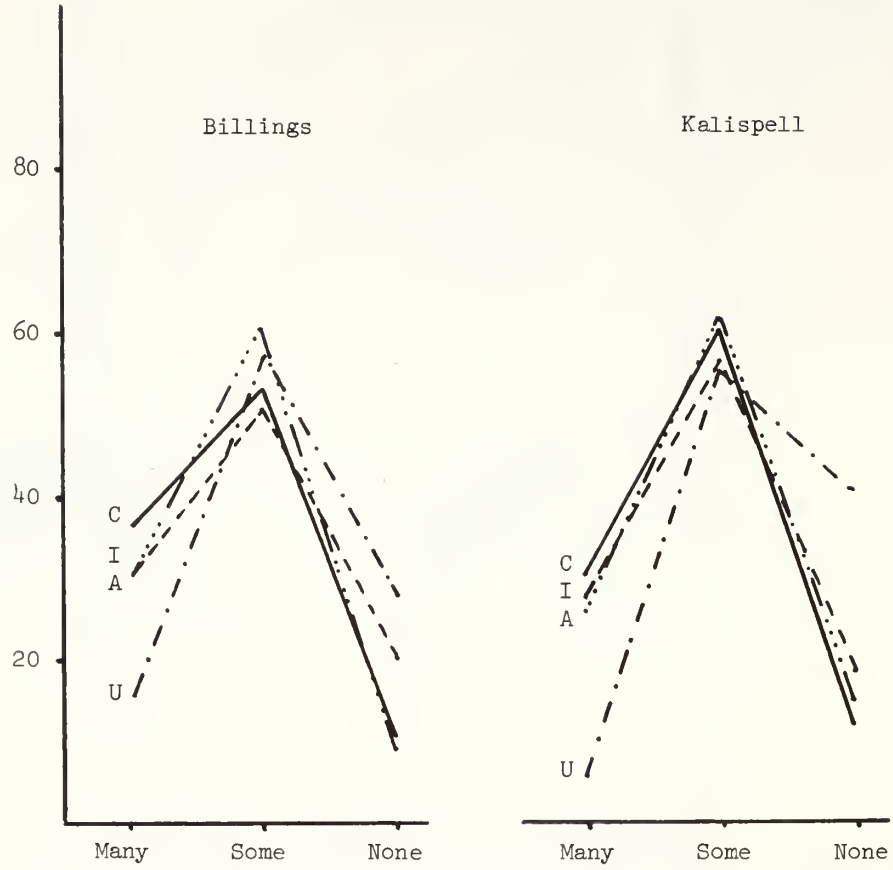


DRIVER BEHAVIOR CHARACTERISTS RATED AS HIGH, MEDIUM, OR LOW ACCIDENT CAUSAL FACTORS BY THE DRIVING PUBLIC

	Billings				Kalispell		
	H	M	L		H	M	L
Agressive	24.1	43.9	32.0	.... —	27.0	44.7	28.3
Careless	48.2	39.4	12.3	————	40.9	42.7	16.5
Inattentive	37.5	43.1	19.5	- - - - - -	32.3	45.6	22.2
Unskilled	20.6	37.8	41.6	-.-.-.-.-.-.	6.8	33.3	59.9

(Data given in percent, by city)

The accident cause ratings of behavioral characteristics in the two locations studied are very similar. Note that careless driving is rated as the highest cause (by approximately 44%) followed by inattentive, aggressive, and unskilled driving in each geographic area of APU activity.

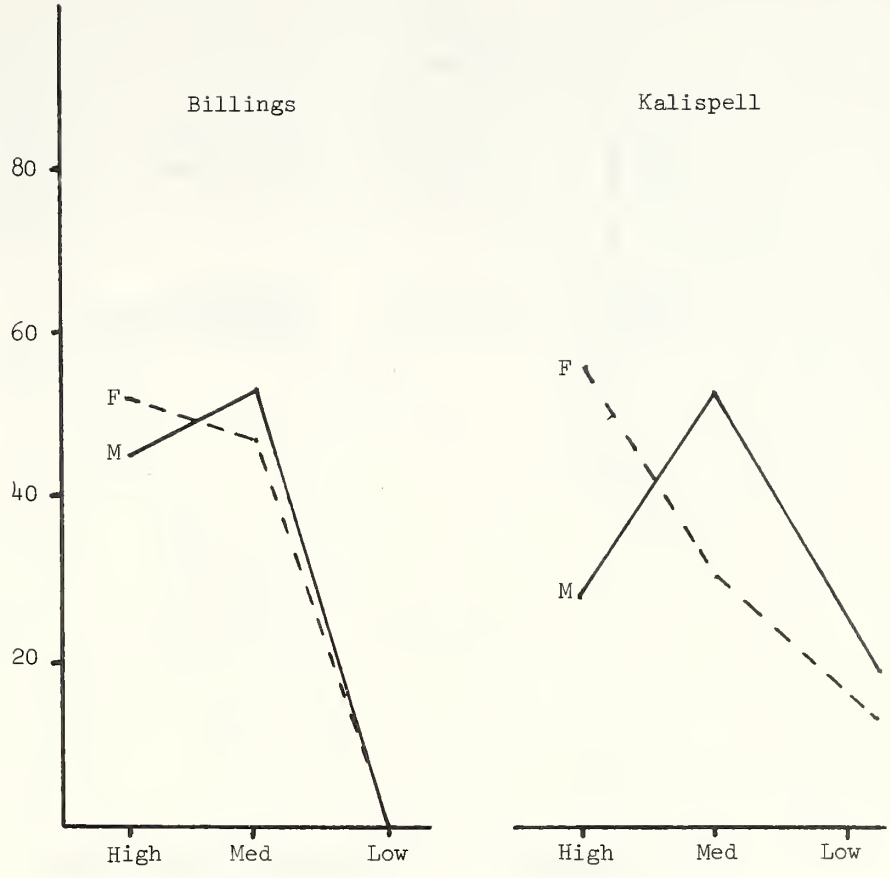


OBSERVED FREQUENCY OF UNSAFE DRIVER BEHAVIORAL CHARACTERISTS AS REPORTED ON PUBLIC QUESTIONNAIRE

	Billings				Kalispell		
	M	S	N		M	S	N
Aggressive	30.1	60.3	9.6	... — ..	25.2	60.7	14.1
Careless	35.4	53.2	11.4	————	30.1	59.0	10.9
Inattentive	30.1	50.9	19.0	- - - - -	26.5	55.5	18.1
Unskilled	15.5	56.8	27.7	-.-.-.-.-	5.6	54.9	39.4

(Data given in percent, by city)

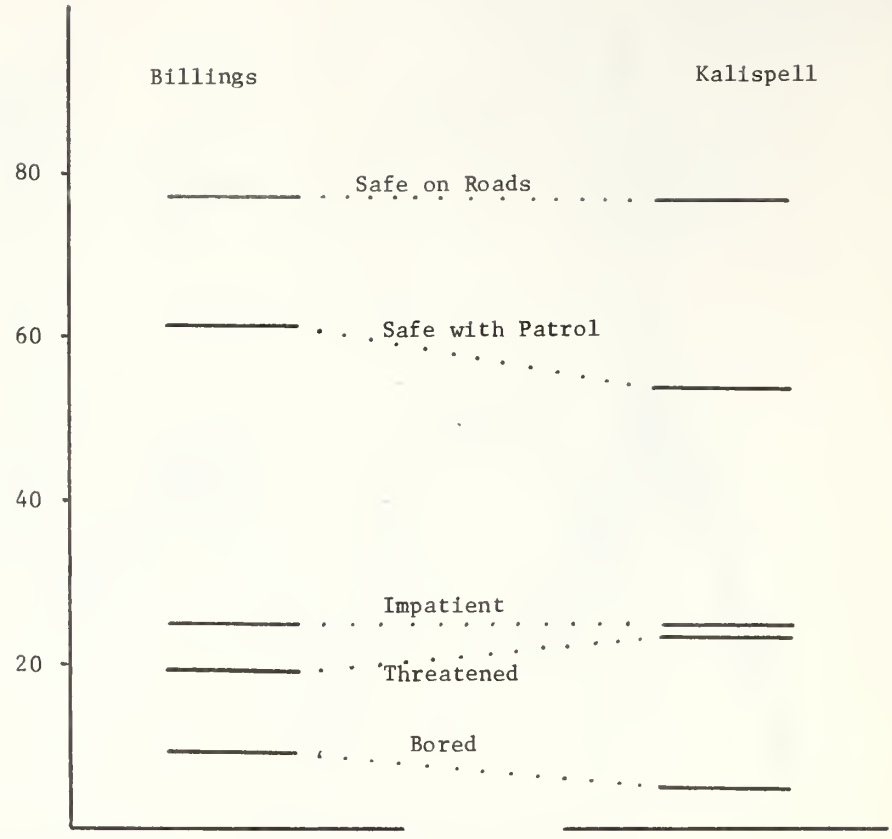
It is important to note that both locations react in a very similar manner regarding observed frequency of unsafe driver behavior. While the four behavior characteristics were observed in nearly equal frequencies, careless driving was observed most frequently and unskilled least frequently. It is interesting to note that the ranking of observed unsafe practices is identical to their rating as accident causal factors.



CARELESS DRIVING AS AN ACCIDENT CAUSE, SEPARATED BY SEX OF QUESTIONAIRE RESPONDENT

	Male ←			Female - - - - -		
	H	M	L	H	M	L
Billings	45.6	53.7	0.7	52.2	47.8	0.0
Kalispell	27.6	52.9	19.5	55.8	31.2	13.0

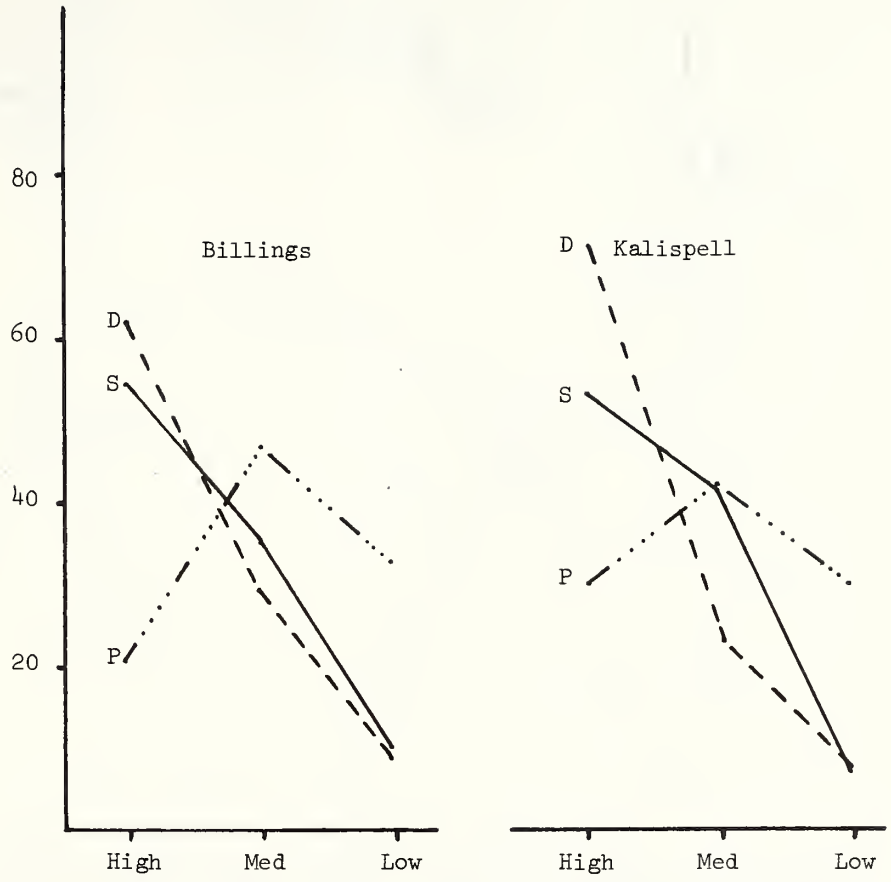
Note that there is very little difference in the perception of the male - female public in Billings regarding carelessness as an accident cause. However, in Kalispell the male drivers clearly do not recognize careless driving as a high cause of accidents. When age as well as sex is considered, it is males in their 40's that do not consider carelessness as a high accident cause.



DRIVER CHARACTERISTICS AS REPORTED ON QUESTIONNAIRE

	Billings	Kalispell	Overall
Do Feel Safe on Area Roads	77.3	76.7	77.0
Presence of Patrol Increases Safety	61.3	53.8	57.6
Impatient With Other Drivers	25.2	25.3	25.2
Feel Threatened While Driving	18.9	23.0	21.0
Feel Bored While Driving	9.4	5.4	7.4

Drivers from the two areas are very similar in regard to these psychological characteristics.

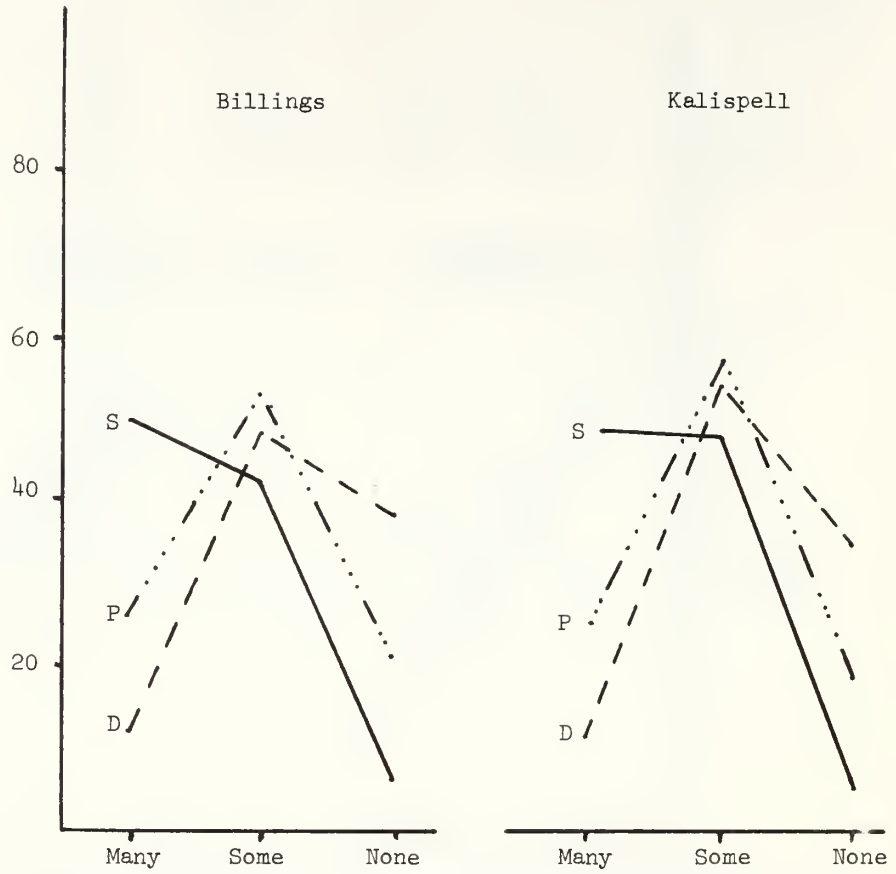


SPEEDING, DRINKING, AND IMPROPER PASSING RATED AS ACCIDENT CAUSAL FACTORS BY PUBLIC

	Billings				Kalispell		
	H	M	L		H	M	L
Speeding	54.4	35.2	10.3	———	52.9	40.9	6.2
Drinking	62.2	29.0	8.8	- - - -	70.4	23.1	6.5
Passing	21.0	46.7	32.4	— .... —	29.6	41.4	28.9

(Data given in percent, by city)

Note the strong similarity of accident cause identification ratings in the two locations. When improper passing is looked at by age of drivers, over 50% of the teenage drivers rate it as a low accident cause and only an approximate 25% of older drivers rate it low.

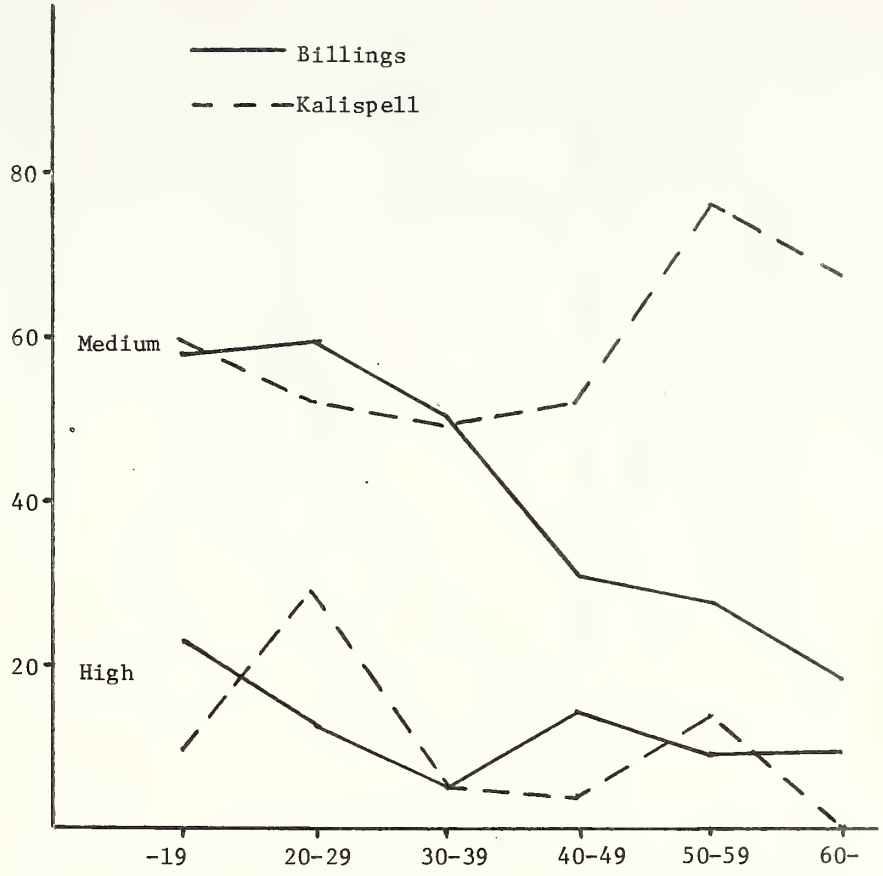


OBSERVED FREQUENCY OF SPEEDING, DRINKING DRIVING, AND IMPROPER PASSING, AS REPORTED ON PUBLIC QUESTIONNAIRE

	Billings				Kalispell		
	M	S	N		M	S	N
Speeding	51.7	42.7	5.6	———	48.0	47.4	4.7
Drinking	12.6	49.3	38.1	- - - - - -	11.7	53.9	34.4
Passing	26.4	53.7	20.3	— .... —	24.8	57.0	18.2

(Data given in percent, by city)

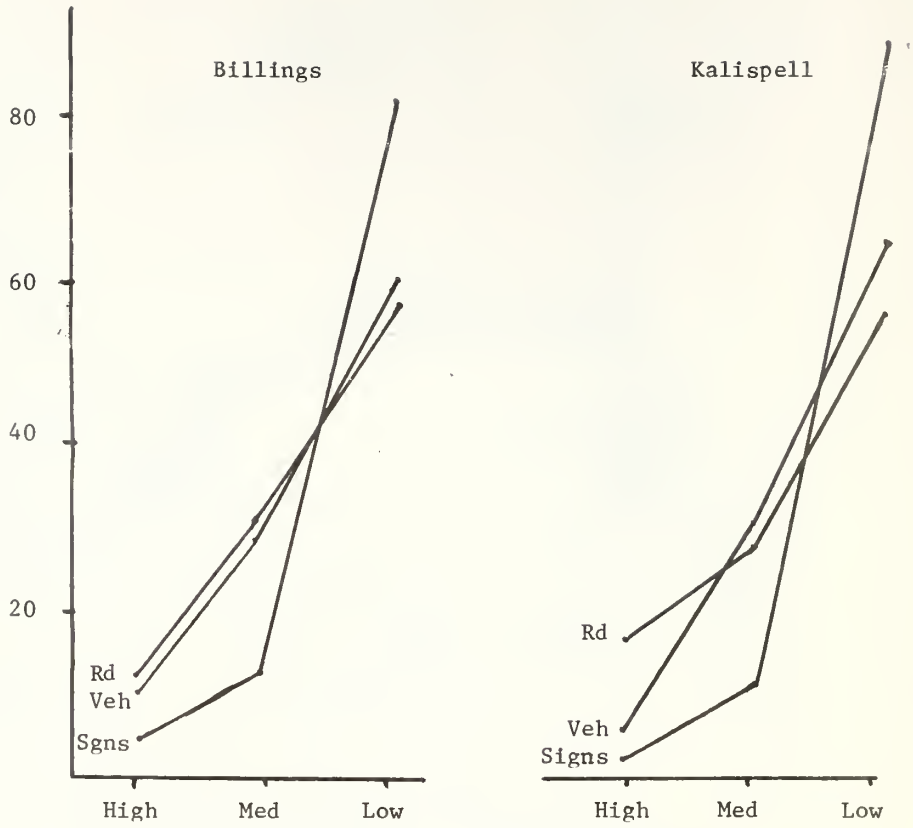
When age is considered, drinking drivers were observed by well over twice as many teenagers in Billings and drivers in their 20's in Kalispell, than were observed by drivers of other ages. This fact reflects a basic difference in the two communities and indicates the respective age groups in which anti-drinking driver campaigns could be conducted.



FREQUENCY WITH WHICH DRINKING DRIVING WAS OBSERVED BY DRIVING PUBLIC, BY AGE

Age	Billings		Kalispell	
	H	M	H	M
-19	22.6	58.1	8.8	58.8
20-29	12.4	59.6	28.2	51.3
30-39	5.3	50.0	5.1	48.7
40-49	14.3	31.4	3.2	51.6
50-59	9.1	27.3	12.5	75.0
60-	9.1	18.2	0.0	66.7

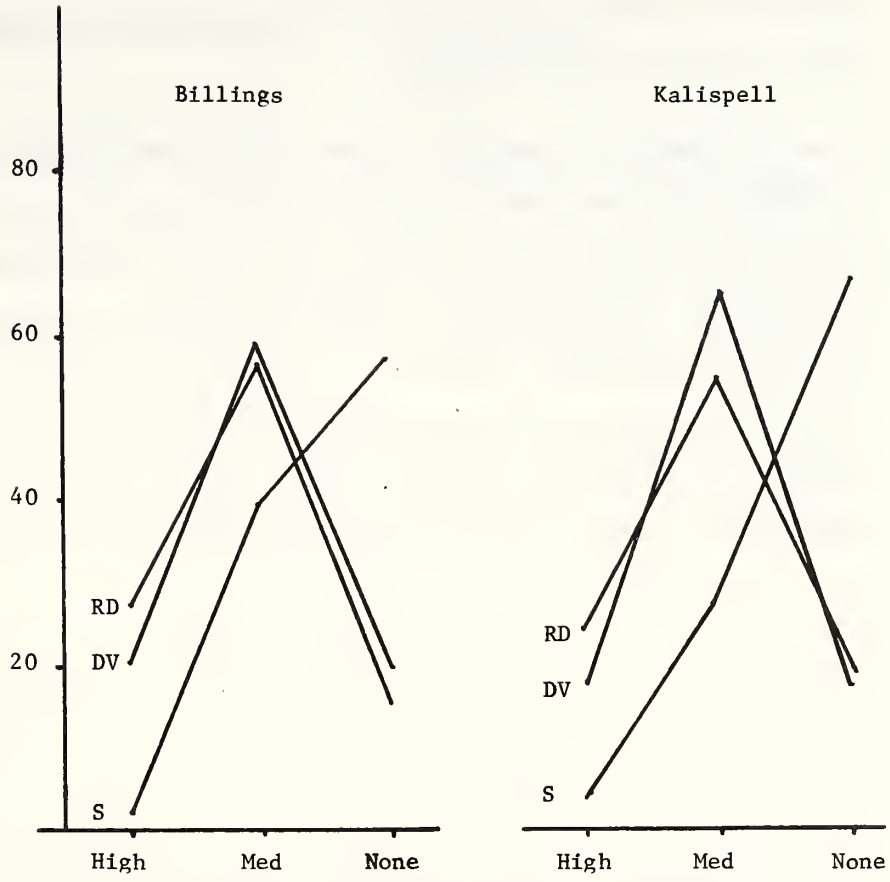
There are important differences between the two cities. The greatest frequency of drinking driving was observed by teenagers in Billings but by 20-29 year olds in Kalispell. Assuming persons are primarily observing their peer groups this would indicate that teenagers in Billings would be the age group with the greatest tendency towards drinking driving. In Kalispell, moderate amounts of drinking were observed by all ages but greatest numbers by persons 20-29. These observations would be consistant with the socio-economic aspects of the two areas.



PUBLIC PERCEPTION OF ACCIDENT CAUSES

	Billings			Kalispell		
	H	M	L	H	M	L
Vehicle Defects	8.7	29.6	61.6	5.9	30.9	64.2
Inadequate Signs	3.9	13.0	83.1	2.0	11.4	86.6
Road Defects	11.2	30.7	58.1	16.2	27.9	55.8

The two locations have a very similar profile regarding these accident causes.



FREQUENCY WHICH UNSAFE CONDITIONS WERE OBSERVED BY DRIVING PUBLIC

	Billings			Kalispell		
	H	M	N	H	M	N
Defective Vehicles (DV)	20.8	59.3	19.9	17.6	65.4	17.0
Inadequate Signs (S)	2.3	39.7	57.9	4.5	28.8	66.7
Road Defects (RD)	27.4	57.5	15.0	25.1	56.9	18.0

The two cities are very similar regarding these unsafe conditions. Inadequate signing is observed very seldom, but road defects are observed by approximately one fourth of the drivers.

General open comments were written on the questionnaire by the public both in Billings and in Kalispell.

Comments covered many aspects of highway safety, more stringent driver licensing regulations, need for daytime speed limits, raising nighttime speed limits, danger of drinking drivers, and motor vehicle inspection requirements. Law enforcement officers were praised for courtesy, helpfulness, and general good work. A few complaints were also made, too few patrolmen (more men have been added since the questionnaire was completed), too lenient enforcement in cities, and a couple of comments clearly made by persons that had recently been given summons for traffic vilations.

Generally the comments indicated that the persons were being entirely cooperative and that they had identified very well with the problems of highway safety and law enforcement, while none offered any utopian concepts or solutions to highway problems. The accident prevention unit received a number of favorable comments and none which were critical.

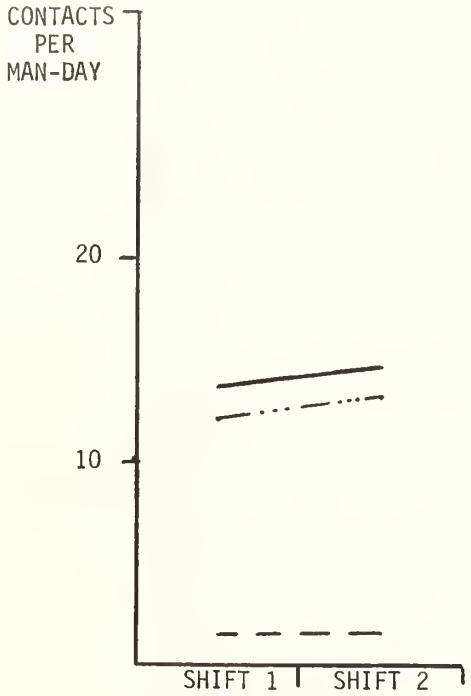
Enforcement Unit Performance and Administrative Data

The statewide Accident Prevention Unit discussed in this evaluation normally consists of five fully equipped Montana highway patrolmen. One of these, the unit leader, is an officer. The normal shift of duty is ten days of eight hours worked and four days off. The first and last work days are used for travel between enforcement sites and home stations.

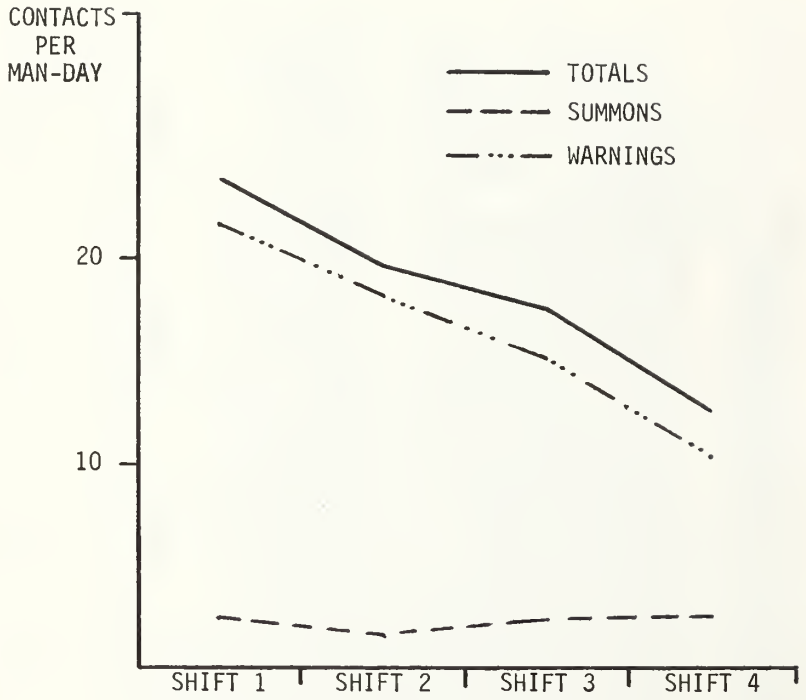
The unit was formed in October 1972 and through the end of 1972 had contacted approximately 10,000 drivers. Contacts are shown below by site and shift for the period covered by this report.

SHIFT	Man Days	Summons	Warnings	Total
Billings Area				
1	40	69	482	551
2	35	55	459	514
Kalispell Area				
1	50	109	1084	1193
2	40	56	723	779
3	50	112	754	866
4	50	114	510	624

This data is graphically portrayed on the following pages. Further breakdowns of warnings and summons' by violation type, site, and shift are also shown.



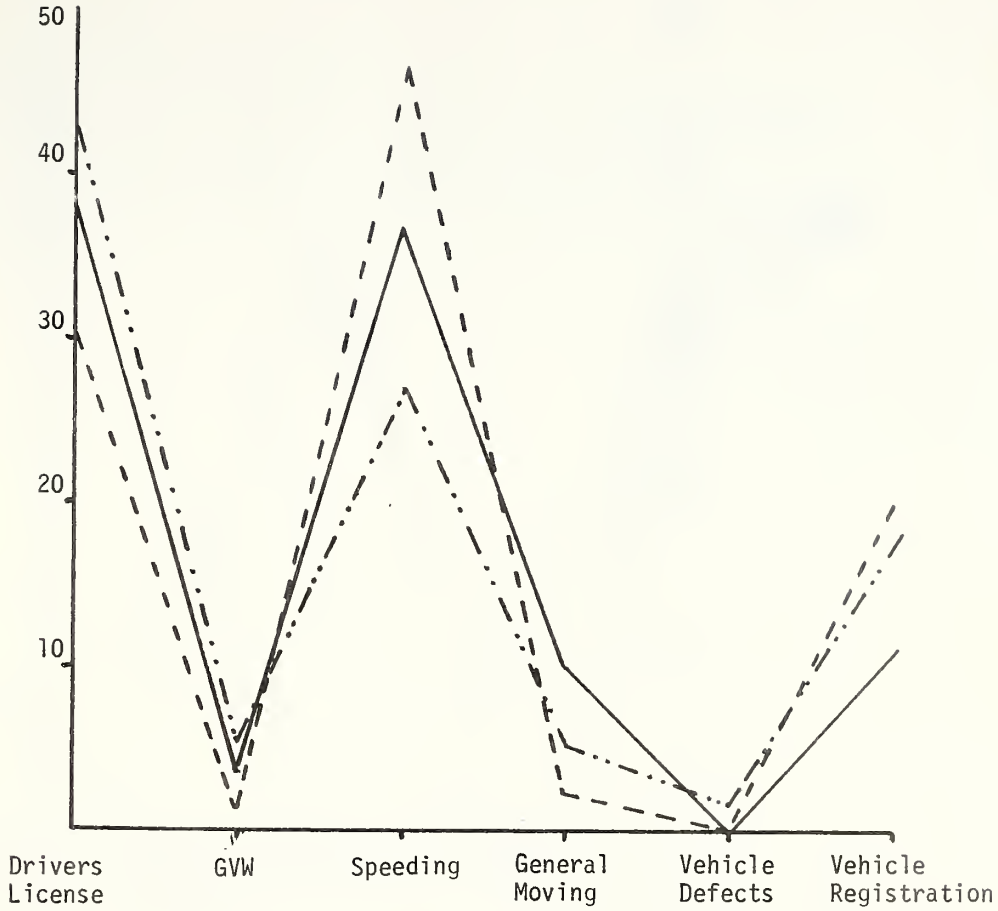
BILLINGS AREA: Contacts per Man-Day worked.



KALISPELL AREA: Contacts per Man-Day Worked.

Billings area data covers only two shifts of enforcement and does not establish any visible trend.

Kalispell area data, however, covers four separate shifts of work by the APU and does show certain trends. During the Kalispell shifts, warnings per man-day worked decrease over time. While warnings steadily decreased, summons remained at approximately the same level throughout the four shifts. Also noted is a higher number of summons per man-day were given in Kalispell than in the Billings area.

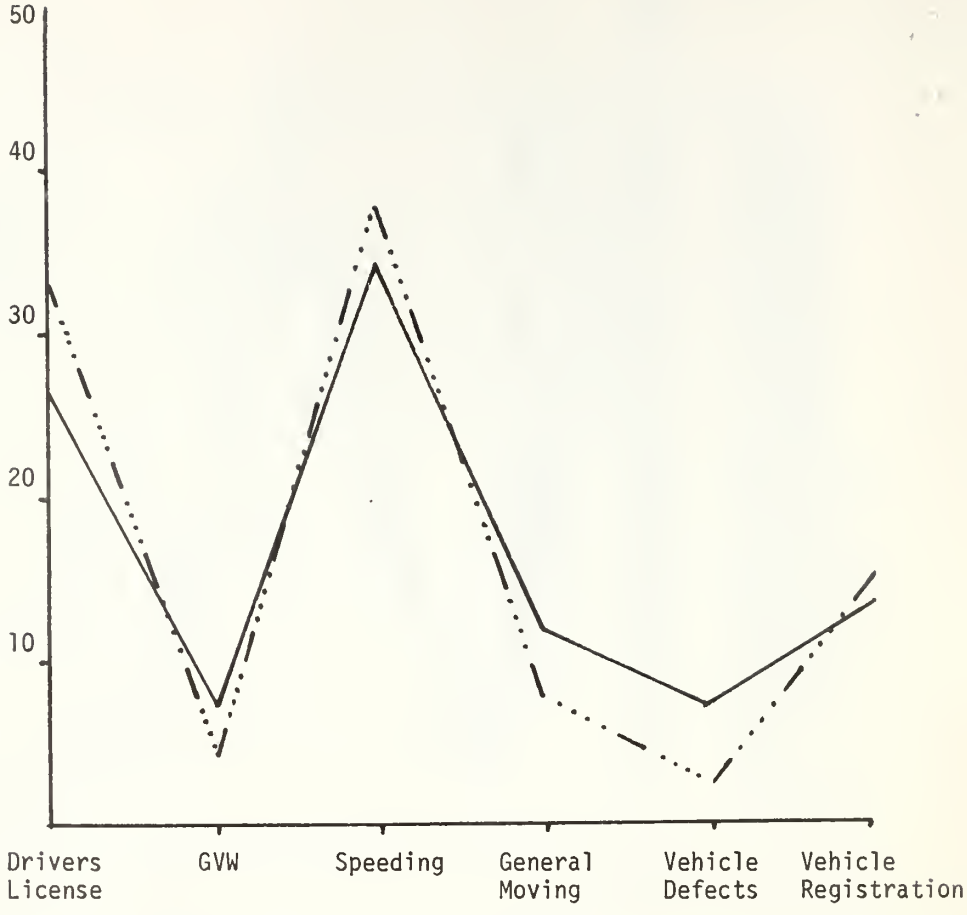


SUMMONS ISSUED: KALISPELL 1973

Violations	May 8-28	June 2-9	June 15-24	Total
Drivers License	38.5	42.9	29.5	33.0
GVW	3.7	5.3	1.8	4.4
Speeding	36.7	26.8	46.4	37.4
General Moving	10.0	5.4	2.7	7.7
Vehicle Defects	0.0	1.8	0.0	2.3
Vehicle Registration	11.0	17.9	19.6	15.2

$\chi^2 = 20.68$, Prob ($\chi^2 \geq 20.68$) = .147

This illustration shows the proportions of summons given during the first three enforcement periods. These three distributions and the total are all statistically equivalent. This would indicate that the level of enforcement of the various types of violations remained steady during the entire period. The final enforcement period, July 13-22, is treated on the next page.

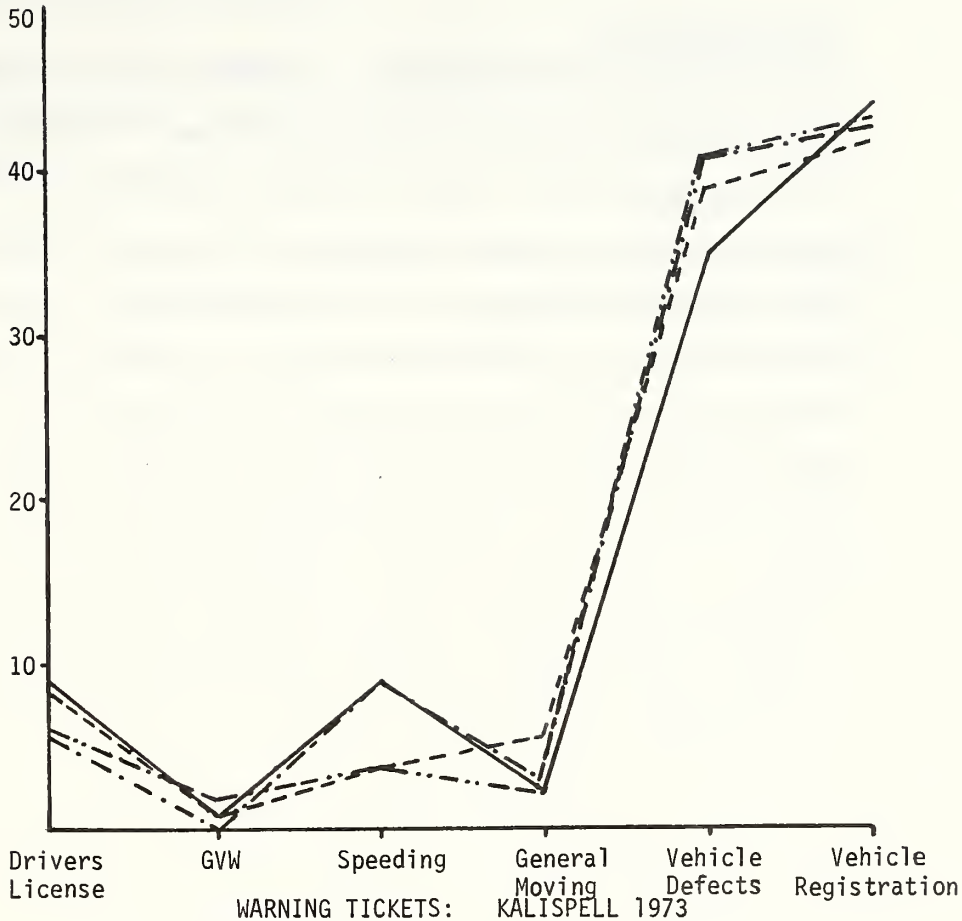


SUMMONS ISSUED: KALISPELL 1973

Violations	July 13-22	May 18-June 24
Drivers License	26.1	33.0
GVW	7.2	4.4
Speeding	34.2	37.4
General Moving	11.7	7.7
Vehicle Defects	7.2	2.3
Vehicle Registration	13.5	15.2

$\chi^2 = 11.34$, Prob($\chi^2 \geq 11.34$) = .044

The final period of enforcement was conducted by a different accident prevention unit team and the distribution of summons issued during this time period is statistically different from the overall distribution during the previous enforcement periods.



WARNING TICKETS: KALISPELL 1973

Violation	May 18-28	June 2-9	June 15-24	July 13-22	Total
Driver License	9.0	6.5	5.7	8.9	7.6
GVW	0.4	1.7	0.0	0.4	0.6
Speeding	8.9	4.1	8.6	4.0	6.8
General Moving	2.6	2.4	2.9	6.0	3.1
Vehicle Defects	35.0	41.1	41.0	38.9	38.5
Vehicle Registration	43.7	43.7	42.8	41.7	43.3

$\chi^2 = 12.03 \quad \text{Prob}(\chi^2 \geq 12.03) = .90$

This illustration shows the pattern of proportions of types of warning tickets issued during four time periods of law enforcement. There is no significant difference in these four distributions. While the proportions of types of warning tickets did not change, as seen previously actual numbers issued decreased considerably.

Cost-Benefit Data.

This subsection was to have contained cost-benefit estimates covering the period of this evaluation in two selected sites. At the conclusion of the enforcement period, after all accident data was compiled no measureable change in accident experience can be noted. This does not imply either cost-effectiveness or cost-ineffectiveness. It does imply that the periods of enforcement were too short in duration to enable definite measurement of true change from statistical variation. The number of accidents including fatal, injury and property damage experienced in a three to five week period of selective enforcement, in a given site in rural Montana, is low. In order to measure a true change in accident experience, for cost-benefit analysis, a greater number of accidents and thus a longer period of selective enforcement at a site will be required.

Improvement of Evaluation Techniques

This subsection contains suggestions for improvement of evaluation techniques in highway safety programs in general, and for a selective enforcement countermeasure evaluation in particular.

Of major importance is a planning phase which should preceed any evaluation task. This planning phase should include a complete determination of all data elements required in the particular evaluation project togeather with all sources from which the data elements may be obtained. The planning phase should also contain a complete time frame layout with every aspect of the time frame examined in detail to determine the feasibility of completing the various evaluation tasks according to a schedule. Any special equipment required for an evaluation should be field tested prior to completion of the planning phase and begining of formal evaluation. The resulting plan should be periodically inspected and updated throughout the actual evaluation. This inspection would allow for appropriate adjustments in the evaluation scheme as needed. Also included in the evaluation plan should be an estimated buget which allows a period of time for draft revision and finalization of the evaluation report. Another necessary part of the plan should be the option to stop any activity which has been conducted during the formal evaluation and writing of a terminal report of action to that time with explaination for activity termination. This type of evaluation plan would allow changes of priorities and activities involved in an evaluation if unforeseen problems are encountered which render original evaluation objectives unattainable.

Another factor encountered during this evaluation is the sparseness of accidents in a rural Montana location. It must be recognized that any highway safety study which requires accident data is attempting to measure a rather rare occurance. For this reason, statistical significance of any result is difficult to attain. This does not imply that comparison of accident rates, accident types or projections cannot be made but that these comparisons will generally be based and made using professional judgement rather than statistical significance. Also involved in accident data is the tendency of accident causes, accident types and traffic profiles to change considerably with time. There is no good alternative to the use of professional judgement togeather with reported data to avoid this problem. The factor of accident rarity was encountered during this evaluation in both the Kalispell and Billings areas. The number of accidents in these areas is not great enough for an accident prevention unit to quickly impact future accidents.

MONTANA SAFETY